Photo Pirie MacDonald

EDSEL FORD, President Ford Motor Co.

"We will get more than bombers from Willow Run."

Photo Pirie MacDonald

EDSEL FORD, President Ford Motor Co.

"We will get more than bombers from Willow Run."

THE importance of heavy bombers to the success of the United Nations' offensive cannot be overestimated — for bombers have been the surprise weapon of this war.

We need hundreds and thousands of long-range heavy bombardment aircraft of the B-24 and the B-17 types. It is the job of our Willow Run plant to produce a sizeable share of the B-24's for the Army Air Forces.

It has not been an easy task, getting Willow Run ready for full-scale production. A great deal of credit is due to the thousands of men and women in the plant, most of whom never had worked in an aircraft factory before. Credit must also be shared with the Consolidated Aircraft Corporation, originators of the B-24, and the Army Air Forces for their cooperation in helping Willow Run to get off on the right foot.

The fact that bombers are beginning to roll from Willow Run is due to the kind of teamwork that will win this war, both on the fighting front and on the production front.

But we will get more than bombers from Willow Run.

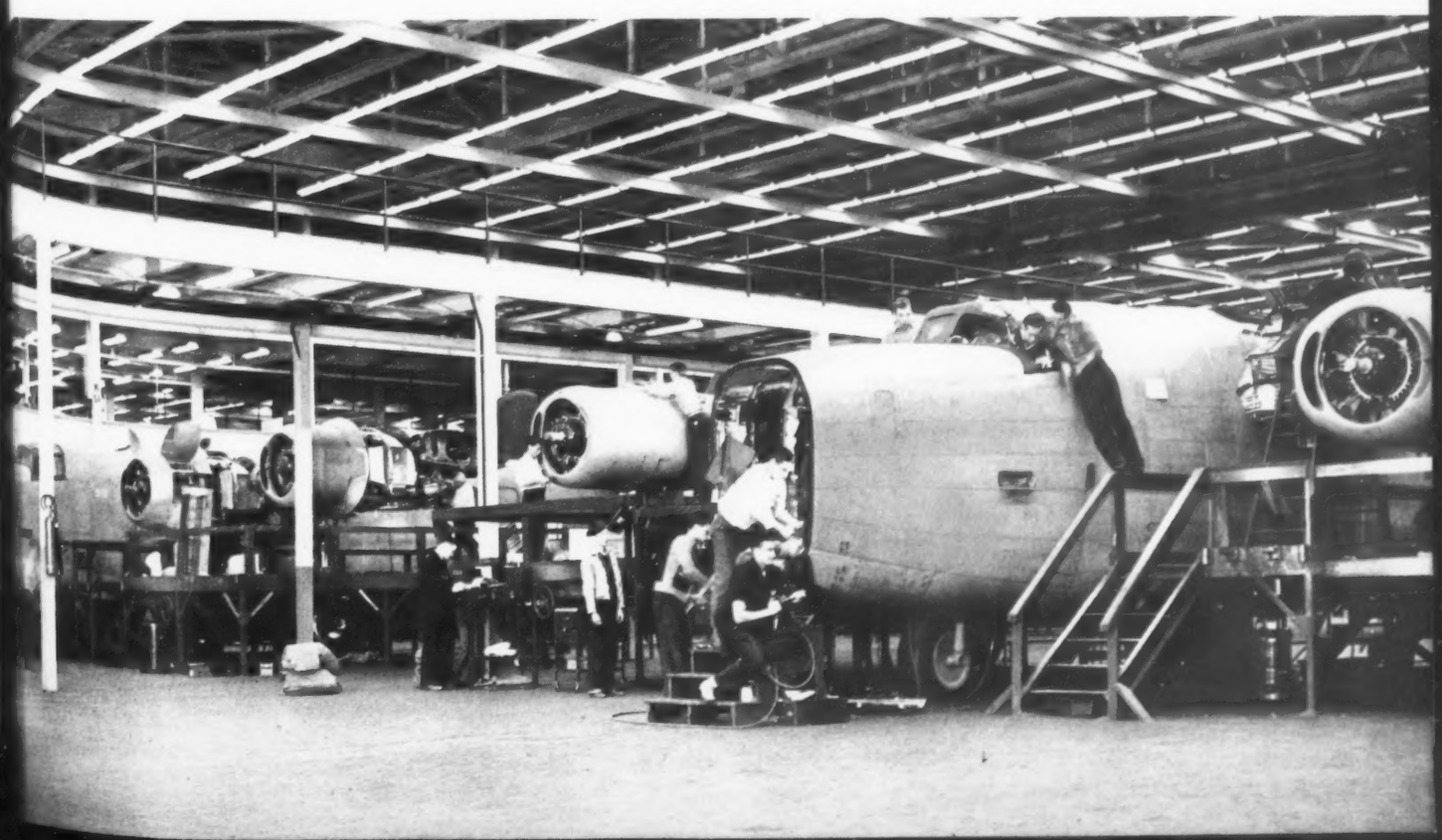
It often has been said that nothing really important comes from any endeavor except the experience it affords. This is true of war—the experience gained in wartime is perhaps the only good there is in it.

Near the sight of the bomber plant there once was a one-room schoolhouse. It was called "Willow Run" after the peaceful little stream that twists through the landscape nearby. Today, our bombers roar over the spot where the schoolhouse stood. The little stream is almost forgotten.

At the huge new plant, the men and women who are building bombers to end the war also are helping to create the background against which the drama of tomorrow's transportation will be played. It certainly won't be a drama solely of aircraft, but the training and experience the workmen and workwomen are receiving will stand them in good stead in the job of rebuilding when peace comes.

Actually, therefore, Willow Run still is a school, more important to the process of education than ever before—the largest one-room schoolhouse in the world.

Henry Ford



THE WILLOW RUN BOMBER PLANT

OUT of this war has come an imposing array of huge industrial plants built solely for turning out weapons of warfare in sufficient quantities to swamp the Axis Powers. One of the greatest of these plants, and certainly the one on which the eyes of the world are focussed at this time, is the Willow Run Bomber Plant, conceived and built by the Ford Motor Co. for the express purpose of turning out four-engine bombing planes at an unprecedented rate. Production miracles are about to be achieved here in the building of Consolidated B-24 bombers, or "Liberators" as they are popularly called. These planes are capable of carrying an even heavier load of bombs than the Flying Fortresses.

Every inch of space in this huge factory, which is believed to be the largest airplane building plant in the world, pays tribute to the mechanical genius of Henry Ford and his associates. In every detail, the factory was planned and built to apply the mass production methods developed by the automotive industry to a product that differs widely from automobiles and

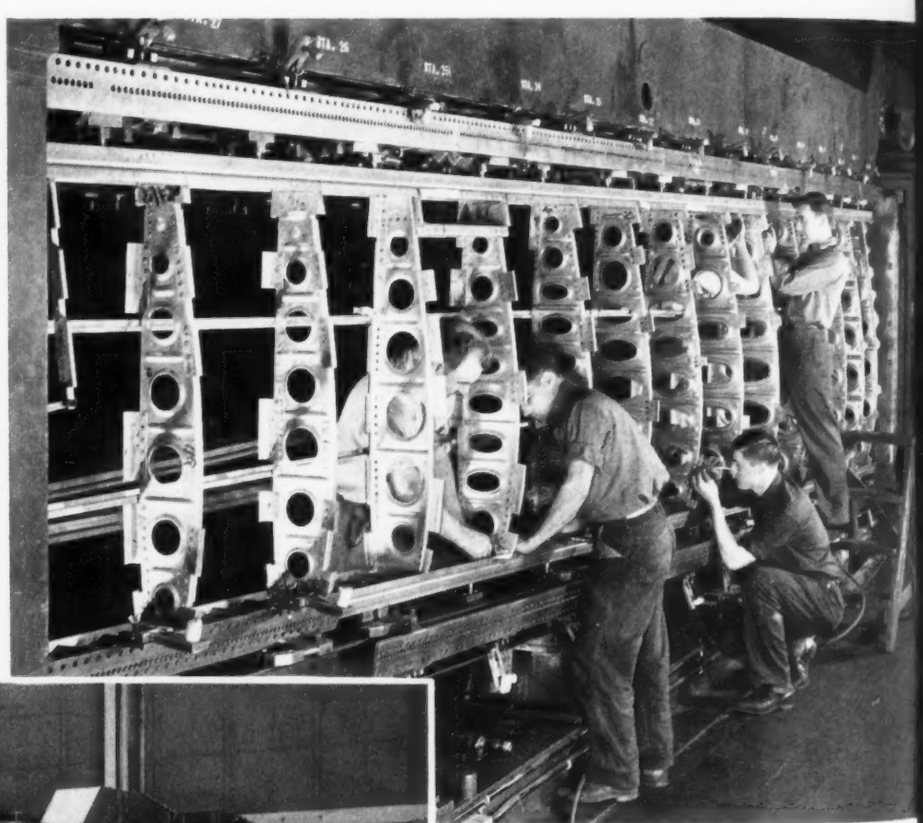


Fig. 1. Jigs Constructed of Sturdy Welded Steel Members, with a Movable Overhead Beam and Sliding Ends, Expedite the Assembly of Wing Panels

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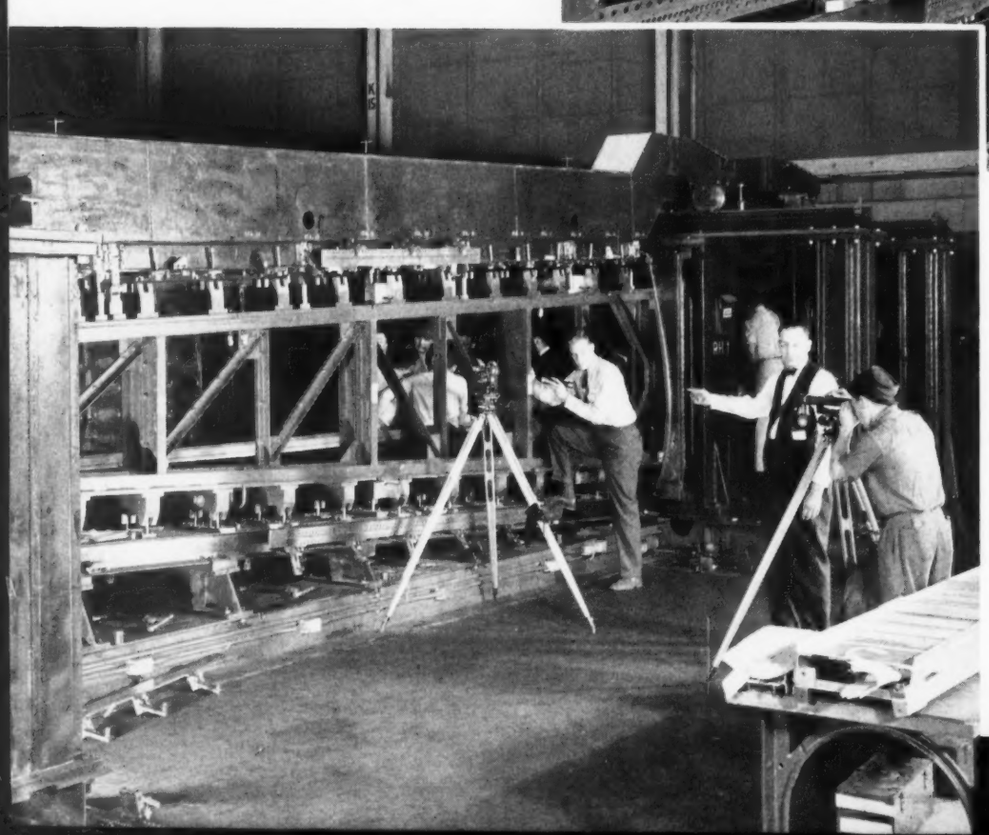

Fig. 2. Checking All Locating Points on the Jig for an Outer-wing Panel by the Use of a Structural Dummy or Gage

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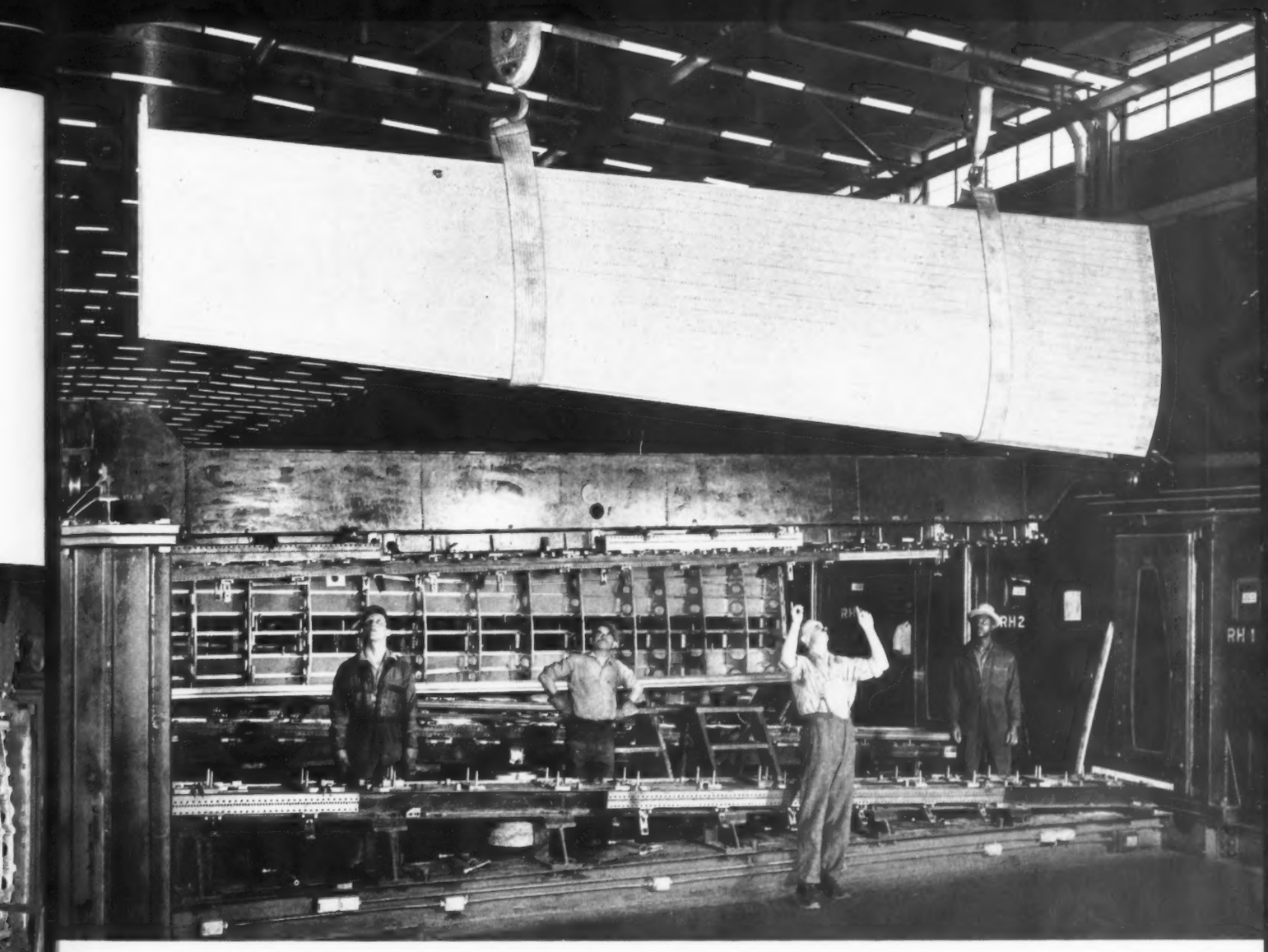


Fig. 3. Outer-wing Panel and Center-wing Jigs are Designed with an Overhead Beam which is Readily Moved Aside to Facilitate Unloading Finished Bomber Sections

motor trucks. Bombers are not yet rolling off the assembly lines at the rate planned, but the manufacturing facilities provided will make possible an output even in excess of that figure as soon as sufficient personnel can be trained. This statement can be freely made, with the proviso that enough materials can be supplied for maintaining such a high production tempo.

When production figures are mentioned in connection with this huge plant, it should always be remembered that the factory not only builds complete bombers, but also produces sub-assemblies which are shipped to other factories for assembly into complete planes. In fact, approximately two-thirds of all units fabricated are shipped to other assembly plants.

Few persons appreciate the stupendous task involved in building a plant of such huge proportions as Willow Run. Over 5,000,000 bricks were used in constructing the building, and 16,000,000 wooden blocks were laid in the floor. There are 5 miles of pipe carrying drinking water, and over 50 miles of steam pipes. More than 100,000 fluorescent lights were installed to provide daylight illumination. Within six months after excavation was started, the production of bomber parts commenced.

To engineers the erection of the building was, of course, the smallest part of the job. It was an even greater task to work out the manufacturing and assembly details and to design and build the 10,000 special jigs and fixtures required. The general production plan was quickly conceived and sketched out by Charles Sorensen, the capable vice-president of the Ford Motor Co., as he sat in his hotel room in San Diego, after having paid several visits to the factories of the Consolidated Aircraft Corporation.

Simultaneously with the erection and equipping of the building, it was necessary to train

Fig. 4. End View of Two Jigs for Assembling Outer-wing Panels, Showing Arrangement of the Overhead Movable Beam

the thousands of workers who are now expertly performing tasks in which they were completely inexperienced a short time ago.

Many ideas unique in the manufacture of aircraft are found at the Willow Run plant. To begin with, overhead conveyors carry newly blanked and formed parts from power presses to other machines in the manufacturing departments and then to sub-assembly departments. Other conveyors carry the sub-assemblies to the outer wing, center wing, fuselage, main, and final assembly lines. The planes on the main and final assembly lines are periodically moved from station to station by floor conveyors. Everywhere throughout the plant work is seen in constant motion, reminiscent of the automobile factories in peacetime. Because all manufacturing and work handling could be planned from the ground up, this plant is literally the production man's paradise. Raw materials enter one end of the building and finished planes leave from the opposite end without any backtracking of work whatsoever.

There are four main assembly lines along which the center wings, fuselages, engines, tail surfaces, pilot and bombardier floors, etc., are assembled. From the ends of these lines, of which two are seen in the illustration on page 123, there extend two final assembly lines along which the outer-wing panels are attached, propellers mounted in place, armament installed, and so on, until complete assembly has been effected. As the completed bombers come off the final assembly lines they are ready for final flight tests.

One of the greatest advances in the manufacturing technique over conventional practice is the development of assembly jigs which are designed for permanency and for convenient checking and ready adjustment of locating points and

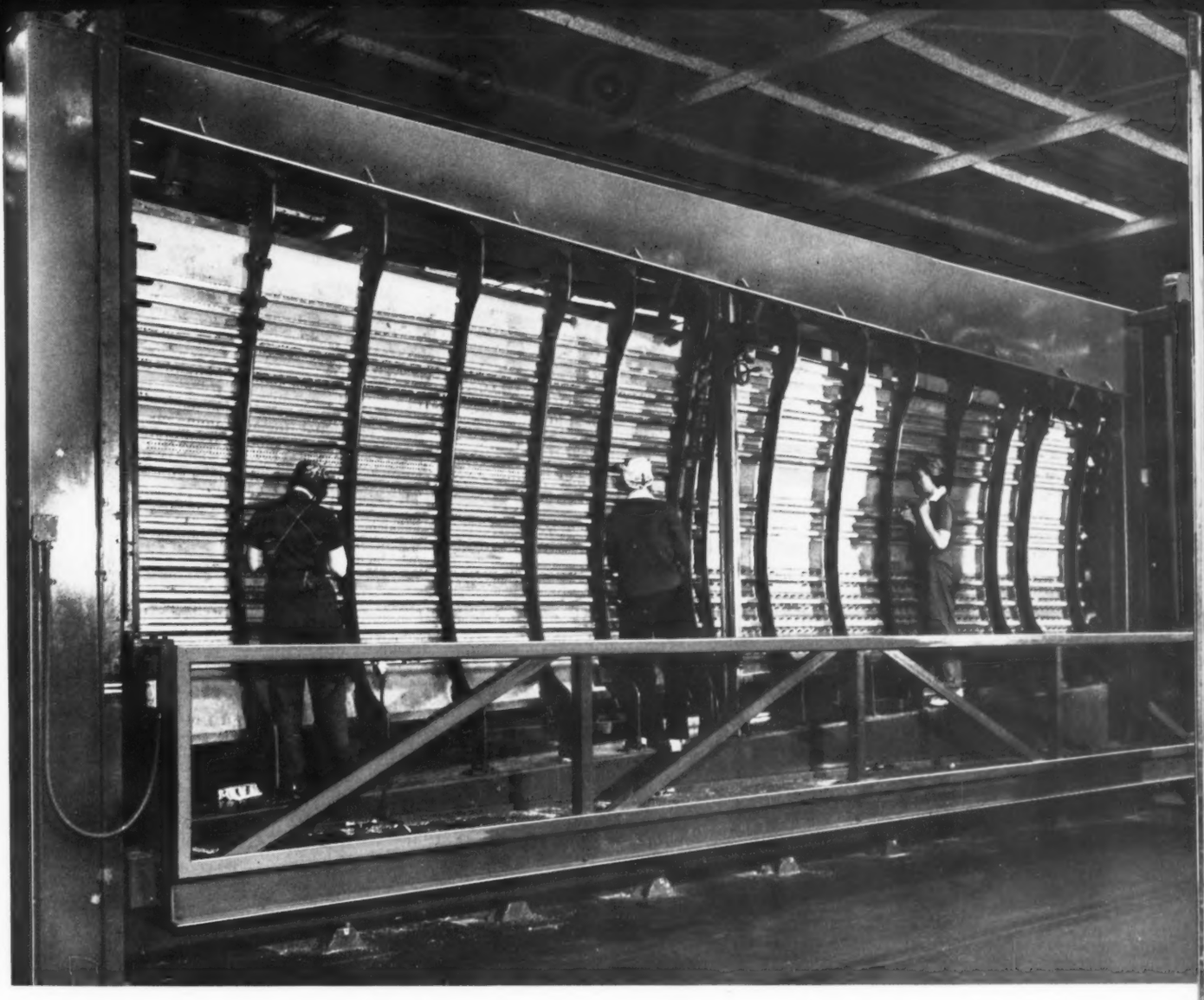


Fig. 5. Jig Used in Fabricating the Stringer and Skin Assembly for Outer-wing Panels is Equipped with Elevator for the Assemblers

clamping members. Fig. 1 shows a close-up view of one of the jigs for a right-hand outer wing panel, with men engaged in assembling the ribs and stringers. Hinged drill-jig plates are seen extending along the top and bottom of the jig.

In Fig. 2, a jig of the same type is being checked for the accuracy of all locating points by the use of a large structural dummy, or gage. The checking points on this dummy are always in the proper position, so that the dummy can be used at a moment's notice.

The jigs for both outer-wing and center-wing sections are designed with a traveling overhead beam in relation to which each assembly is made, as indicated in Fig. 1. When the section has been completely fabricated, this beam is rolled to one side, with respect to the jig center, on tracks at the top of the heavy end supports or columns. The fabricated section can then be readily lifted by means of an overhead crane in the manner illustrated in Fig. 3. The end construction of these jigs will be more apparent from Fig. 4, which shows at the right a jig with the overhead beam moved to one side to facilitate loading, and at the left another jig with its beam locked in the assembling position. Slides in the columns can be moved endwise by handwheels when the time arrives to unload a completed wing panel.

Jigs for the various plane sections are arranged in groups in sufficient number to keep assembly lines supplied and to ship scheduled quantities to the other assembly plants. In the case of right- and left-hand sections, as, for example, outer- and center-wing panels, rows of jigs for the right- and left-hand sections are arranged parallel with each other.

The wing skin and stringer assembly is performed in sturdy jigs designed with a fixed beam, as these assemblies can be lifted conveni-

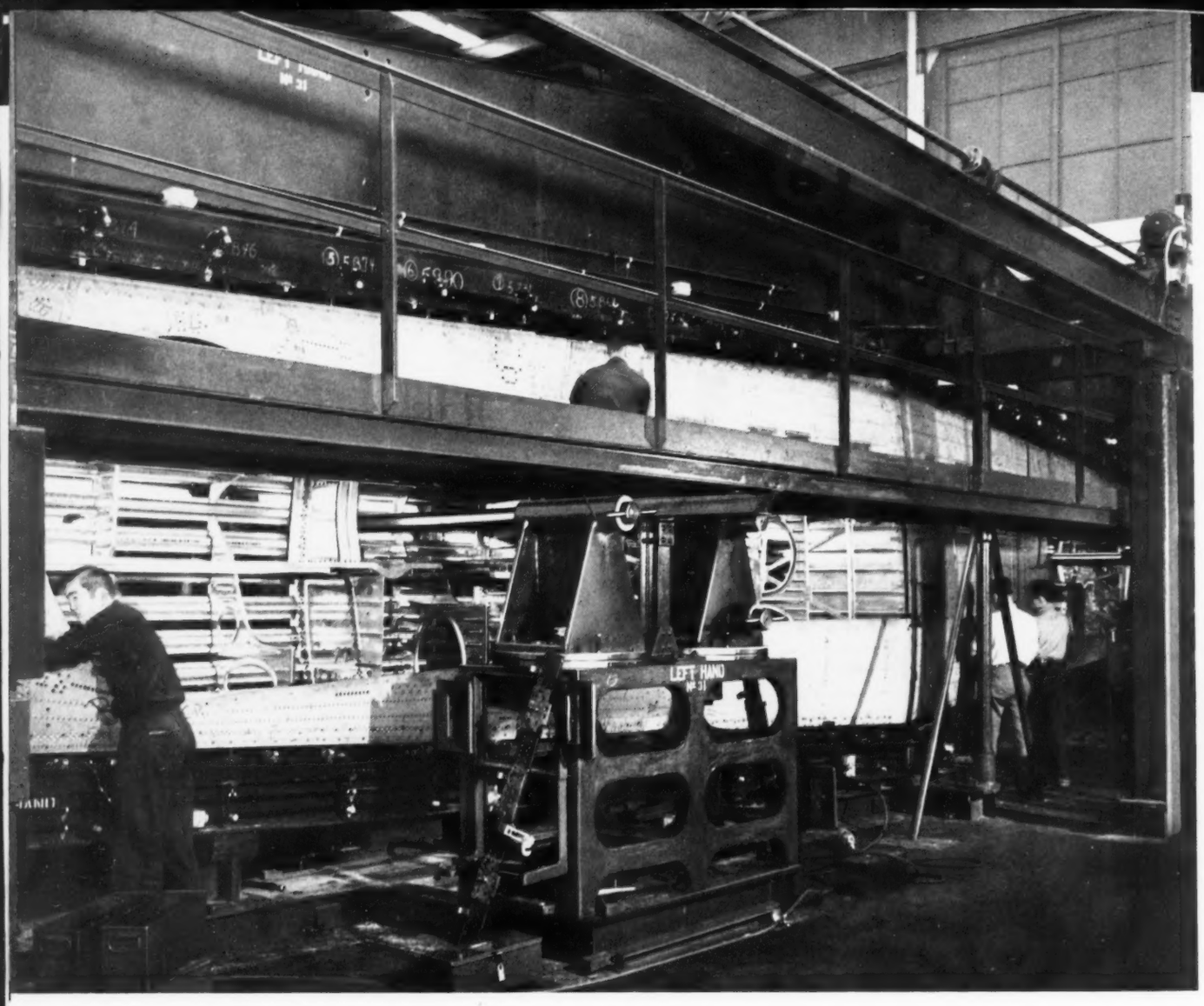


Fig. 6. Locating Units Insure Correct Set-up of the Auxiliary Spars Relative to the Remainder of the Center-wing Sections

ently from the front side of the jigs. These jigs are provided with bridge-like elevators which extend the full length of the jigs at the front and back, as seen in Fig. 5. The elevators are raised and lowered through individual motor drives on the end columns. By their use the men and girls engaged in the assembling operation can be readily brought to convenient working heights. These elevators constitute an important safety feature, as they guard against injuries due to falls. The back of the wing-skin jig is shown in Fig. 5 to illustrate how the stringers are located in slots in vertical bars. The skin had been riveted to the stringers and the assembly virtually completed when the photograph was taken.

The view of one of the huge center-wing section jigs in Fig. 6 shows that these jigs are equipped with permanent platforms attached to the frame of the fixture, for the convenience of the assemblers. Accurate location of the auxiliary spars relative to other important units of this assembly is assured through the use of two locating units positioned on one side of the jig. The left-hand one of these units is seen in the foreground. It is provided with three vertical locating plugs on the ends of long horizontal arms, which are positioned in the landing gear bearings of the auxiliary spars for locating the spars. The skin and stringers are assembled to the fabricated bulkhead and spars in this jig.

As in the case of the outer-wing panel jigs, the overhead beam rolls aside on tracks to permit removal of the assembled section. In these jigs, also, there are slides between the ends of the columns, which are moved endwise for convenience in loading and unloading.

Jigs with elevators at the front and back, similar to those used for the outer-wing panels, and with fixed overhead beams, are employed in

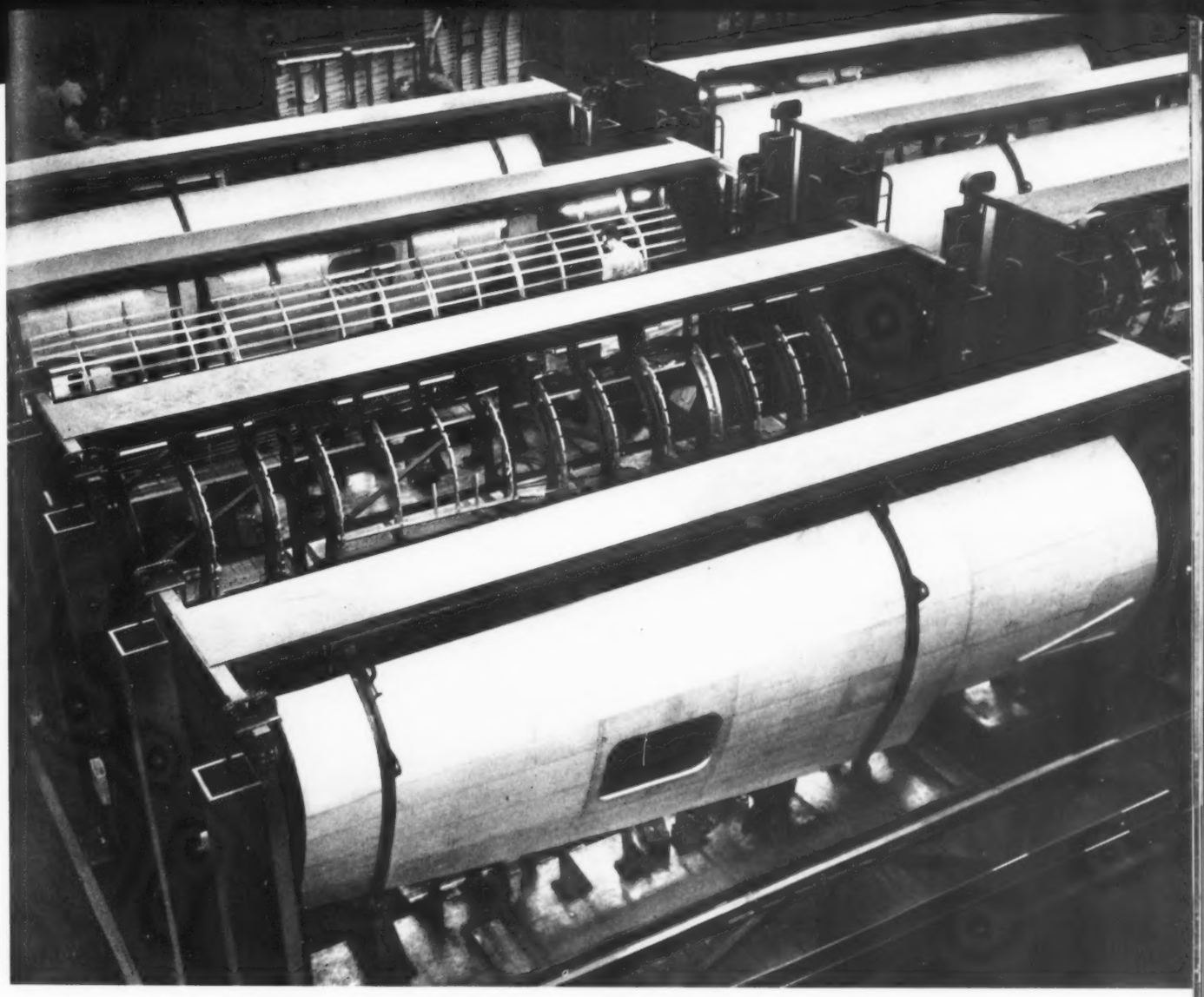


Fig. 7. Fuselage Sides are also Fabricated in Jigs Provided, Front and Back, with Elevators and Constructed with Fixed Overhead Beams

fabricating the largest fuselage sections. Fig. 7 shows in the foreground jigs used in assembling right-hand skin sections, and in the background jigs for left-hand fuselage sections. Straps such as seen attached to the fuselage skin in the immediate foreground facilitate transferal of the sections by overhead cranes from the jigs to the fuselage assembly stations. Some of these stations are shown in Fig. 8.

Tilting jigs or fixtures have been designed to facilitate fabrication of various other sections, such as pilot and bombardier enclosures. A row of fixtures of this type is shown in Fig. 10. The tilting feature enables the workmen to conveniently reach any point of the section being sub-assembled. The types of jigs developed for this plant effect tremendous savings in time.

The principle of conveyorized assembly has been applied in at least one instance in the sub-assembly division through a series of thirty traveling jigs, which are arranged to move continuously around tracks 16 feet apart. These tracks are laid in the shape of an oval, several hundred feet long and about 50 feet wide. One of the traveling jigs of this "merry-go-round" is seen in Fig. 11. Pilot and radio-operator floors are assembled completely during the traverse of one of these carriages around the track. These jigs are also of a tilted construction. The space between opposite sides of the track provides plenty of room for the storage of the parts to be assembled.

When the outer-wing panels are taken from their jigs, they are attached to conveyors which carry them along in a horizontal position, as shown in Fig. 12, while various brackets and other small pieces are riveted in place. Center-wing sections are likewise carried by continuous conveyors. Because of their length and weight, however, it is essential to support these sections

on the ends. This is accomplished by trolley units, designed to run on I-beam tracks, which are temporarily fitted to the ends of the wing sections. A view of one of these center-wing conveyors is shown in Fig. 9.

When the center-wing sections reach the end of the conveyor illustrated in Fig. 9, the sections to be assembled at the Willow Run plant pass under mezzanine conveyors to the head of the main assembly lines. The wing sections to be sent to other plants pass overhead to the mezzanine conveyor, which carries them to the shipping department.

The head end of one of the main assembly lines is shown in Fig. 13. The center-wing section in the foreground is practically as it comes from the assembly line in Fig. 9, while the section at the second station has had part of the fuselage assembled. It will be seen that here, also, the center-wing sections are supported on tracks by trolleys attached to the ends of the sections. As the center wings pass down along this conveyor the various units to be attached are transferred from a slat conveyor on a mezzanine floor that runs between the two assembly lines and parallel to them. This slat conveyor brings the required units from sub-assembly and storage departments. Various sub-assemblies are transferred from the mezzanine conveyor to the main assembly conveyors by means of overhead cranes.

At one station along the line, for example, the complete rear-fuselage section is taken from the mezzanine conveyor by a special crane and lowered into position in a cradle, which holds it at the proper height for attachment to the center-wing section.

Platforms at the various stations along the

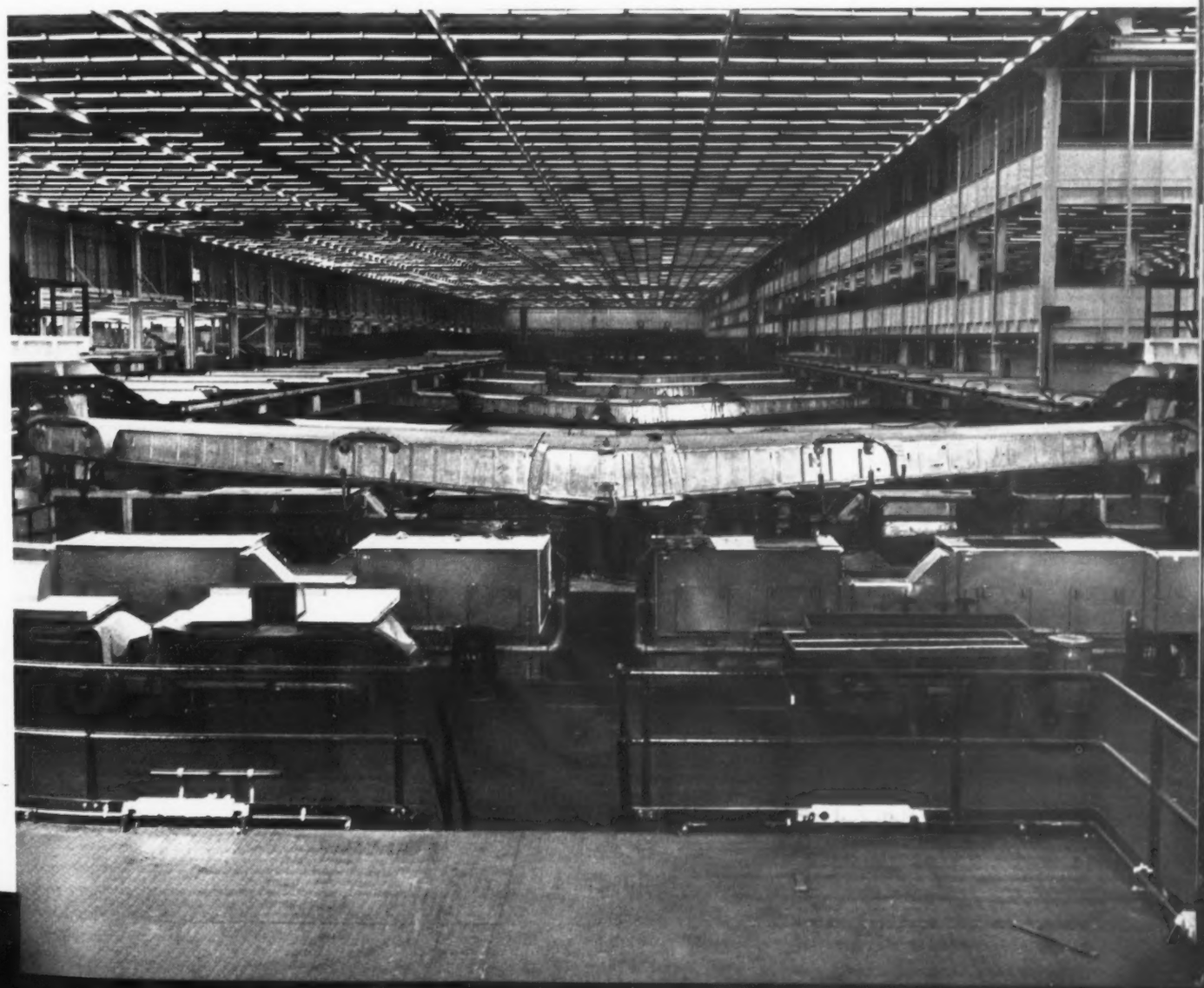
Fig. 8. Rows of Fuselages being put together Immediately ahead of the Jigs in which the Halves were Sub-assembled, Ready for Transferal to the Main Assembly Lines

assembly line facilitate operations. At a certain point, wheels are added to the planes, and from then on, the assemblies ride on these wheels, being pulled from station to station by a conveyor chain concealed in the floor. The trolleys on the ends of the wing sections are dismantled at this point and returned to the head of the conveyor line.

As the bombers reach the end of the main assembly conveyors they are transferred alternately to the corresponding final assembly line. A view of one of these lines is shown in Fig. 14. Almost the entire width of the bay is required for this line, as the outer-wing panels are now assembled and the width from tip to tip of the plane is over 100 feet. The embryo planes are also moved periodically from station to station of this final assembly line by a conveyor installed in the floor. Sections of the platform at each station telescope beneath each other to enable the planes to be advanced. The station seen in Fig. 14 is approximately the last one before installation of the armament commences. The final assembly lines are served by cranes that span the full width of the bay, which is about 150 feet.

The unique methods of assembly described in the foregoing constitute, of course, but one phase of bomber manufacture. In the manufacturing departments also, there are many examples of Ford ingenuity and efficiency. In the press department, for instance, steel punches and dies are used exclusively, the extra cost over zinc-alloy dies being warranted by the large quantities of parts to be produced from each die set. The long rows of presses range from small 10-ton machines to several of 1000 tons capacity. Included in this department is a Cleveland press,

Fig. 9. View of Center-wing Assembly Line Taken from a Mezzanine on which there is a Slat Conveyor which Carries Some Wing Sections to the Shipping Point for Other Assembly Plants



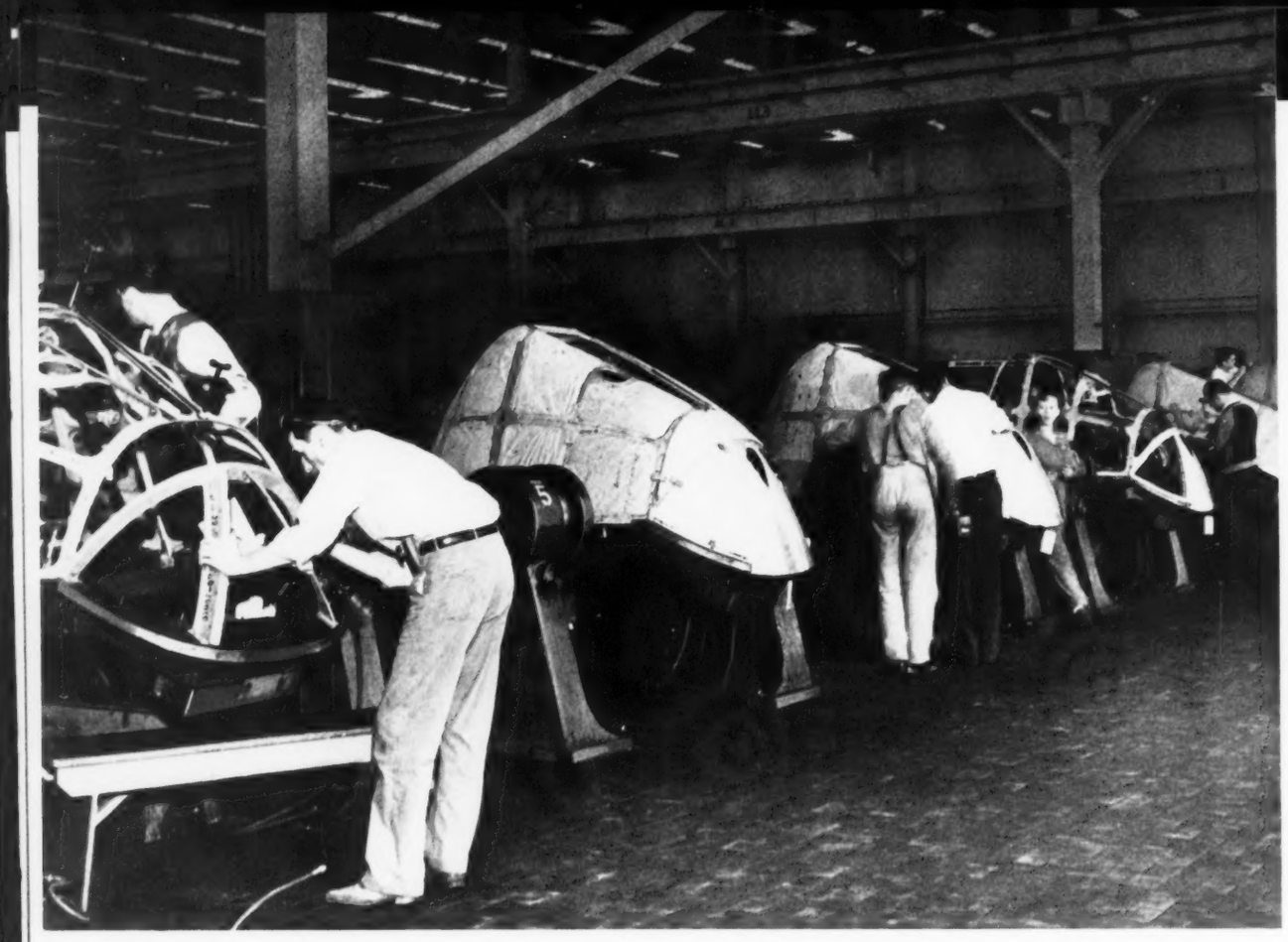
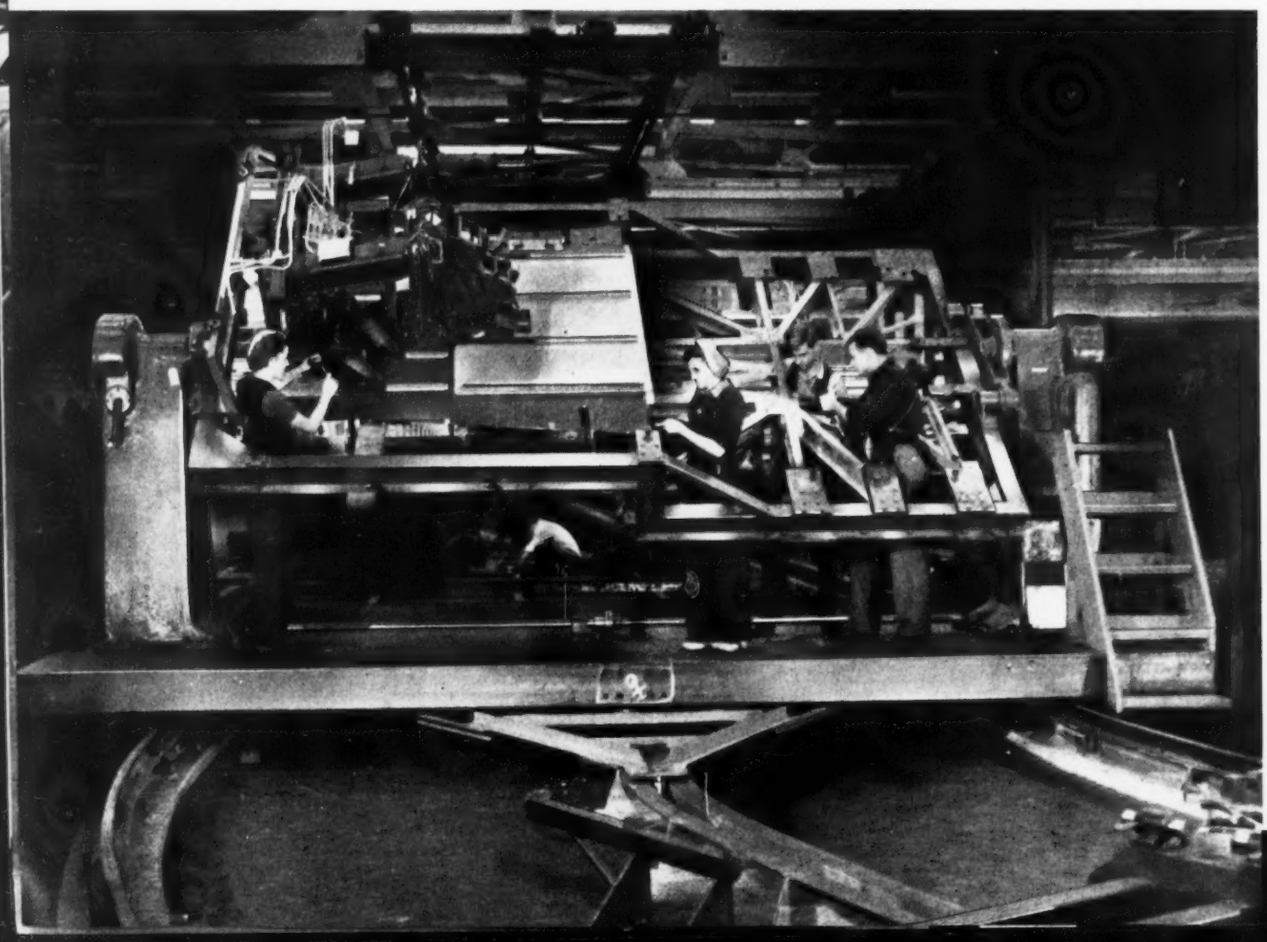


Fig. 10. Tilting Jigs Facilitate the Fabrication of Various Medium-sized Sections, such as Pilot and Bombardier Enclosures

Fig. 11. Large Jigs Move around a Huge Track in a Manner Reminiscent of Methods Developed by the Automotive Industry, in Assembling Combined Pilot and Radio-operator Floors



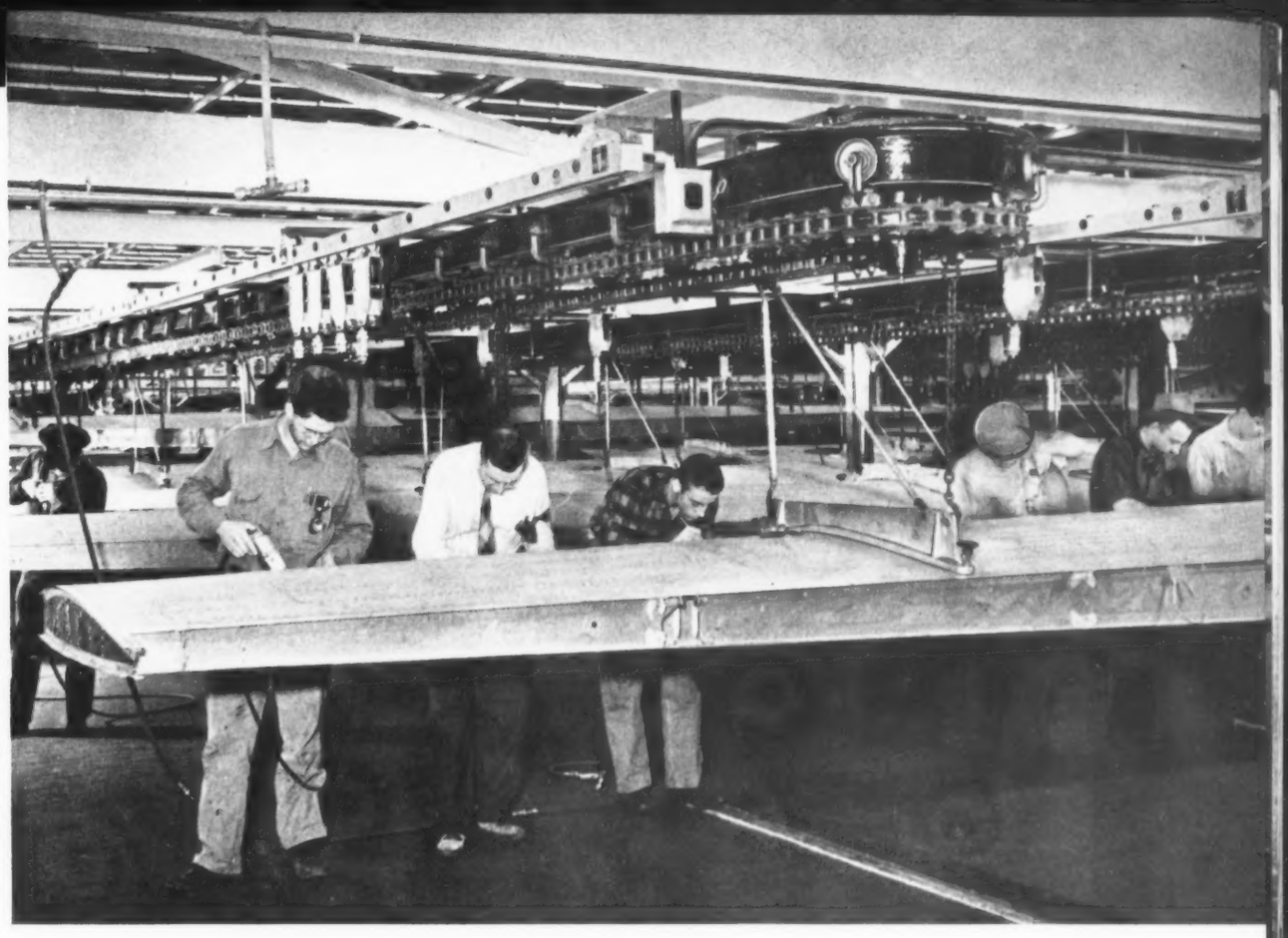
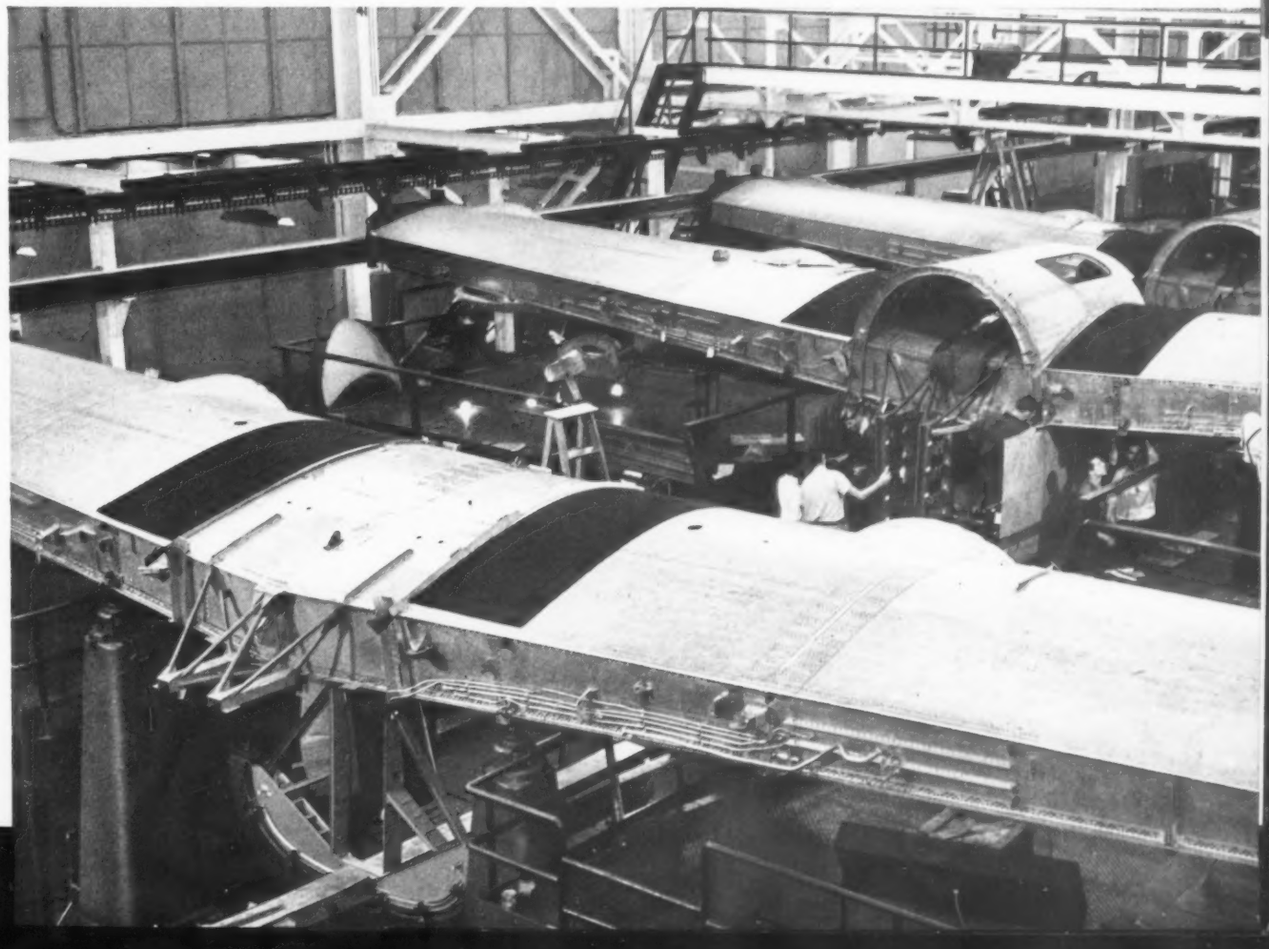


Fig. 12. Outer-wing Panels are Suspended Horizontally from Overhead Chain Conveyors during Final Assembly Operations

Fig. 13. The Head of One of Four Main Assembly Lines, Showing the Method of Supporting the Center-wing Sections during the Preliminary Assembly Operations



built with a die bolster 208 inches for blanking and forming long pieces or producing a number of short pieces simultaneously. Fluorescent lamps installed in the columns of this press, as illustrated in Fig. 15, insure more than adequate lighting over all punch and die surfaces. Bulkhead ribs are being produced in this illustration.

About twenty of the heavy presses are mounted on cast-steel sub-bases (approximately 16 feet high), set in a concrete pit which brings the presses up to the floor level of the shop. This arrangement, developed by Ford engineers from long experience in handling heavy machinery at the Rouge plant, facilitates setting up these presses and reduces by 75 per cent the cost of moving or rearranging them.

Among these machines are four 1000-ton hydraulic presses—two Lake Erie triple-action and two HPM double-action—especially built to Ford specifications. They are the first streamline presses of this type to have their hydraulic equipment located beneath the press instead of towering high in the air on top of the machine. This unique design makes for greater ease in moving dies in and out of the press; but more important, it permits servicing the hydraulic units, changing the oil, etc., without interfering with the operation of the press or adjacent machines, and without tying up an overhead crane.

Two 1000-ton Lake Erie draw presses of the triple-action type are shown in Fig. 16. The one at the left is tooled for operations in the production of nacelle fairings. In the press at the right, the wing-tip top skin is being formed. On both dies, a blank-holder is provided for securely holding the piece during the action of the punch. The aluminum-alloy sheet, already blanked to the required outline, is held by the blank-holder and is formed or drawn by the punch over beads to a depth of approximately 1 inch.

In Fig. 18 is shown one of several 300-ton HPM presses engaged in dishing interior panels by means of a die set that is also equipped with a blank-holder.

As the parts are taken from the presses they are hung on an overhead conveyor, which automatically carries them through a washing machine. Then the washed parts are loaded on racks in the manner illustrated in Fig. 21 for conveying through a continuous heat-treating furnace. As the parts come from the furnace they are automatically quenched in a large tank. The loaded racks are automatically raised and lowered by elevators at the furnace ends.

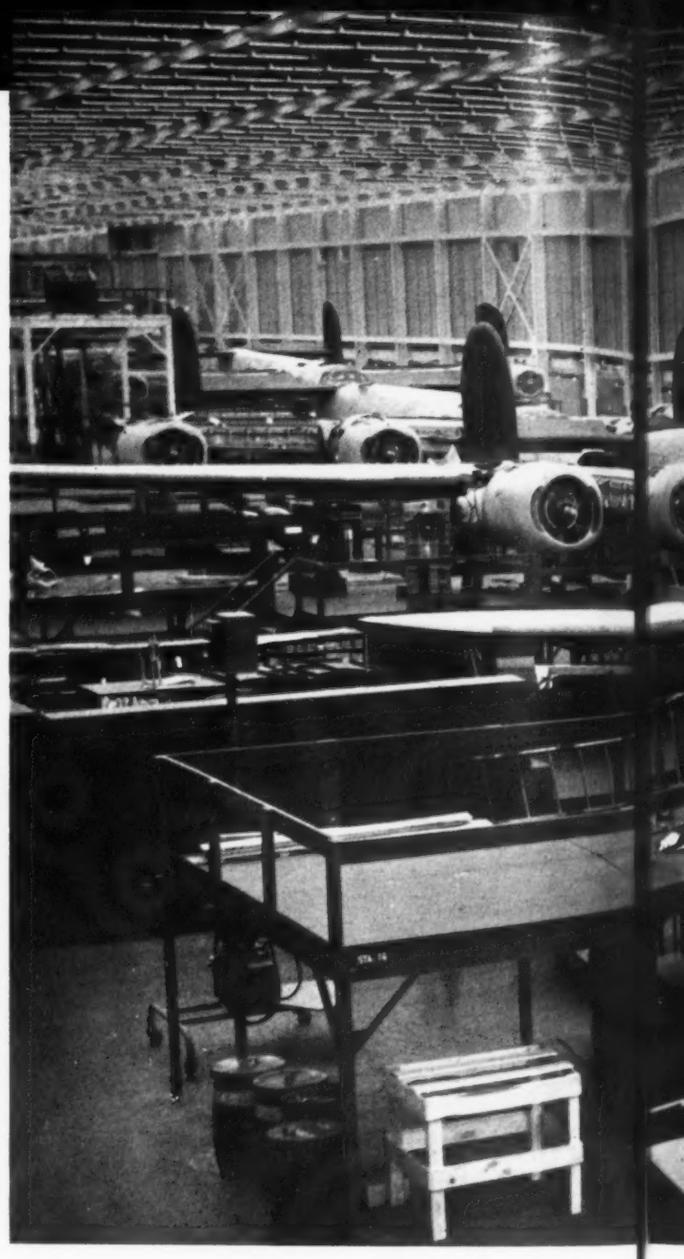
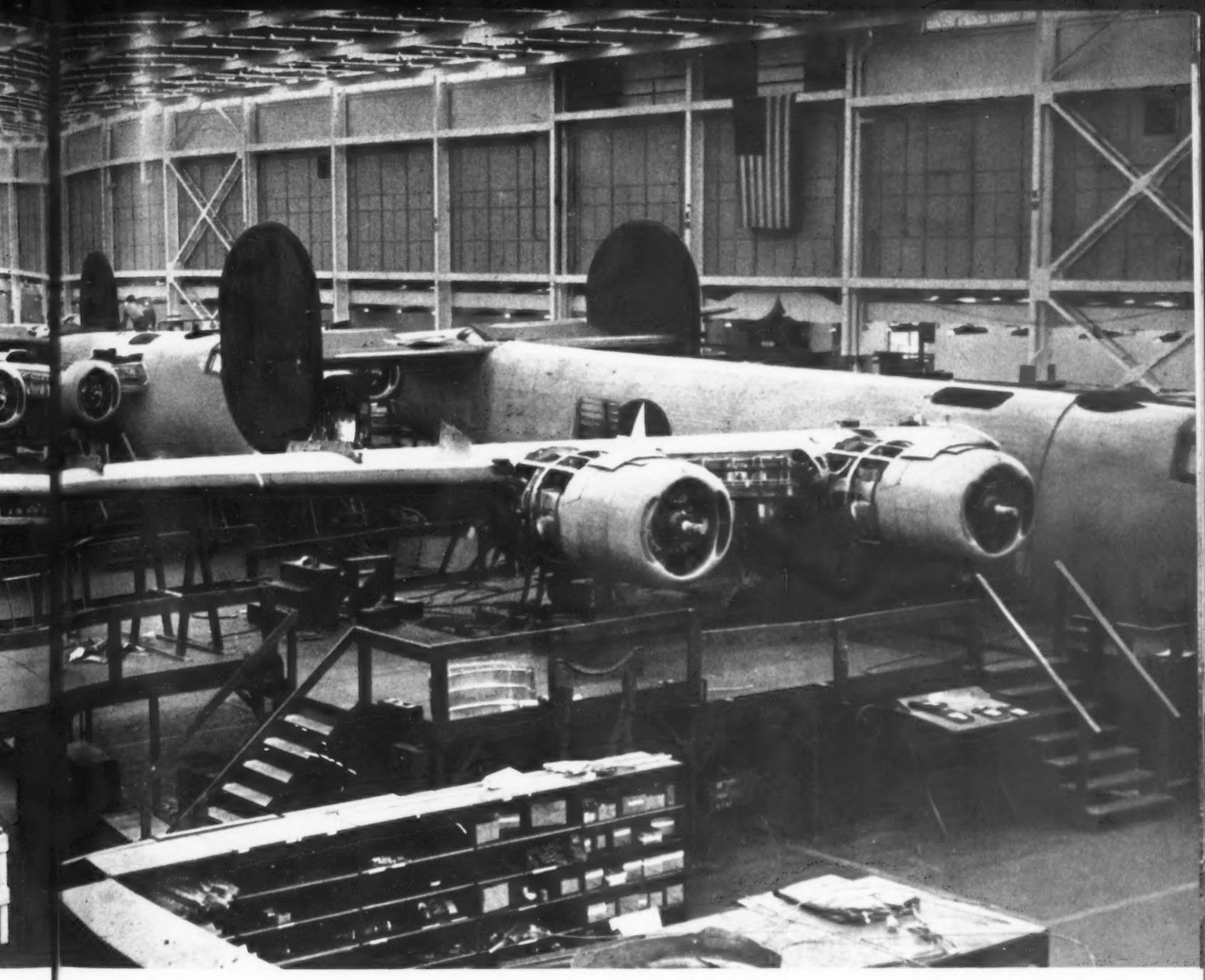


Fig. 14. View of a Plane along the Final

Certain aluminum-alloy parts are placed in refrigerators maintained at a temperature of 20 degrees F. below zero to control aging. Some of these refrigerators are large enough for men to walk around in, as in the case shown in Fig. 17.

After washing, heat-treating, refrigerating, etc., the parts are hung on conveyors such as seen in Fig. 19 for transferal to sub-assembly operations. With this arrangement, aisles are almost completely free from transportation trucks, and parts are transferred to needed points with utmost dispatch.

Several million rivets from 1/8 to 13/32 inch in size are required every day. They are produced by a large battery of National cold-heading machines, of which one row only is shown in Fig. 20. All rivets and some other small



Assembly Line at the Station just Preceding the One where Installation of Armament is Started

parts are given an Alroking corrosion-preventive treatment by the automatic equipment illustrated in Fig. 27. Parts are loaded in quantity into baskets at the head end of the machine, as seen in the foreground. From this point on, the loaded baskets are successively dipped into various baths, after which they are automatically unloaded into a chute at the right of the loading station.

Tank *A* at the left contains a cleaning solution for thoroughly removing grease and dirt from the parts; tank *B*, a clear rinse water for removing all traces of the cleaning solution; tank *C*, an acid bright dip; tank *D*, a water dip; and tank *E*, the first Alrok dip, the parts remaining in this tank four times as long as in the tanks of the preceding stations—in other words, for 14 minutes. Tank *F* is a settling tank of water from which much of the Alrok solution is reclaimed; tank *G* contains clear cold water for "setting" the Alrok coating before the parts go into the next tank. They remain in tank *G* 7 minutes.

Tank *H* also contains Alrok solution, and during the passage of the parts through this tank, all pores are thoroughly sealed. The baskets remain in this tank for 14 minutes. Tank *I* is another rinsing and settling tank from which the solution is constantly dipped back into the Alroking tank. Tank *J* contains a hot water rinse to facilitate drying, which occurs at station *K* where two blowers are installed. The parts are revolved 3 1/2 minutes under each of these blowers. They are dumped automatically from the basket at station *L*, after which the barrels pass again to the loading station. The

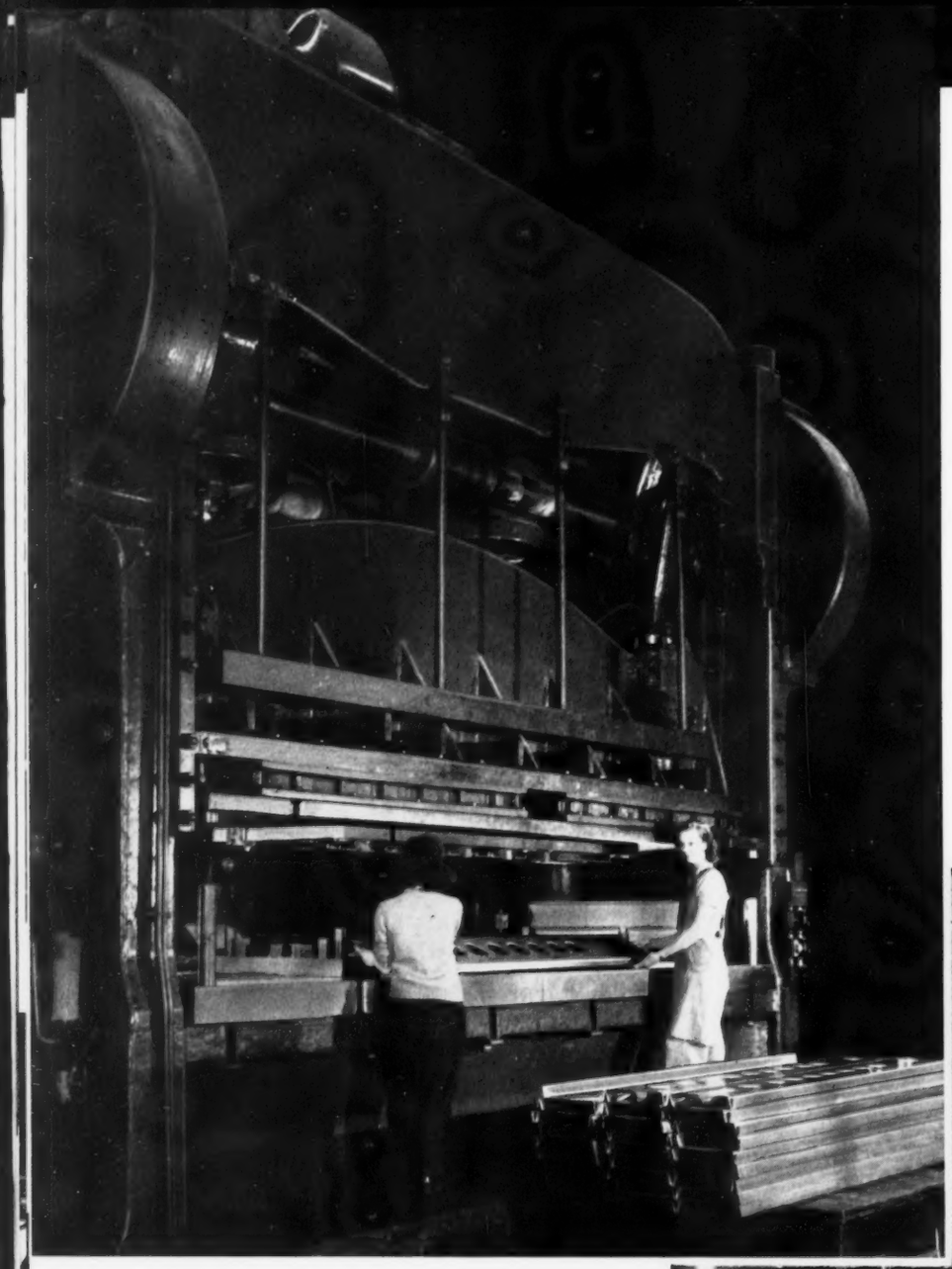


Fig. 15. One of Several Large Power Presses Provided with Fluorescent Lamps in the Columns to Insure Adequate Lighting of Punch and Die Surfaces

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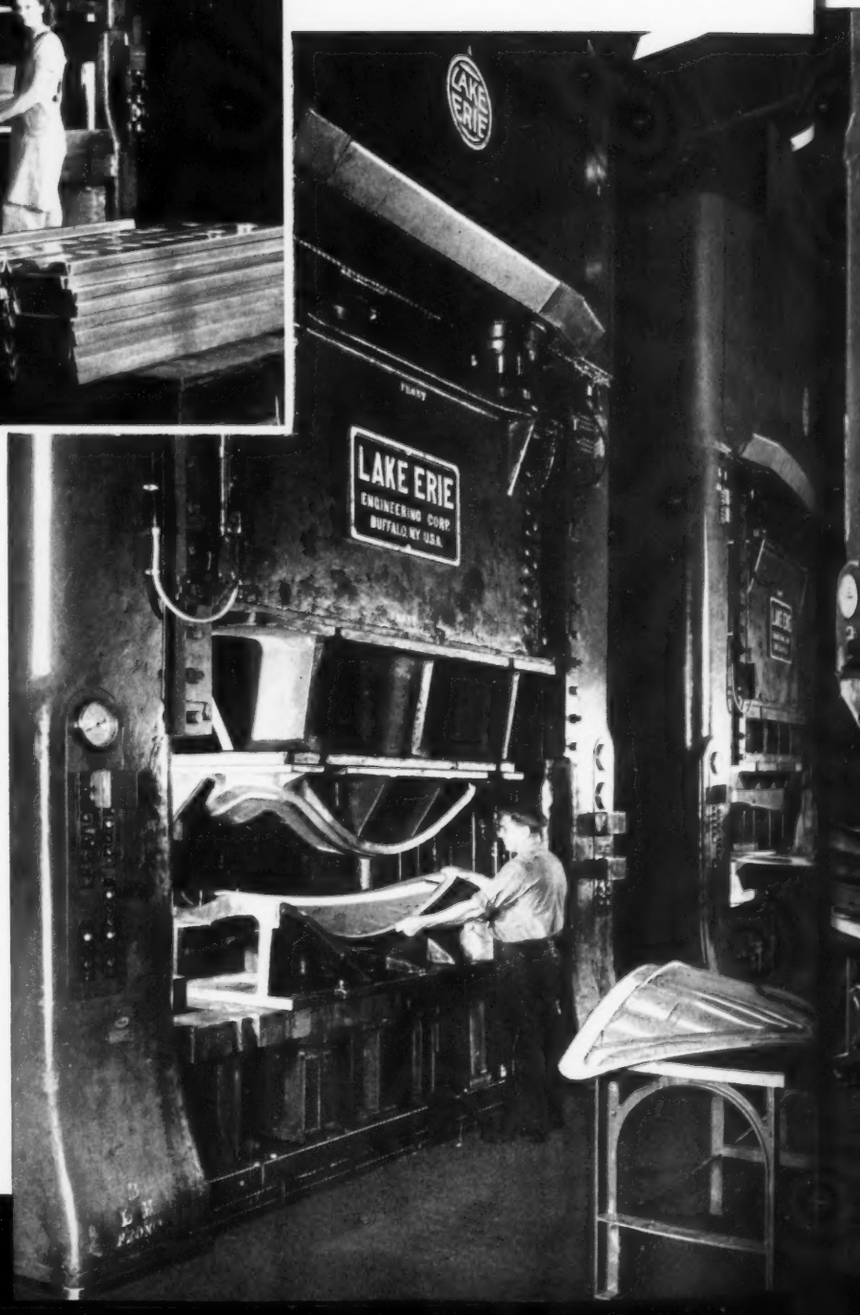

Fig. 16. Two Huge Presses Employed for Blanking and Forming Nacelle Fairings by the Use of Dies Made of Steel to Insure Long Life

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Fig. 17. One of a Number of Refrigerators Maintained at a Temperature of 20 Degrees F. below Zero to Prevent Aging of Aluminum-alloy Pieces

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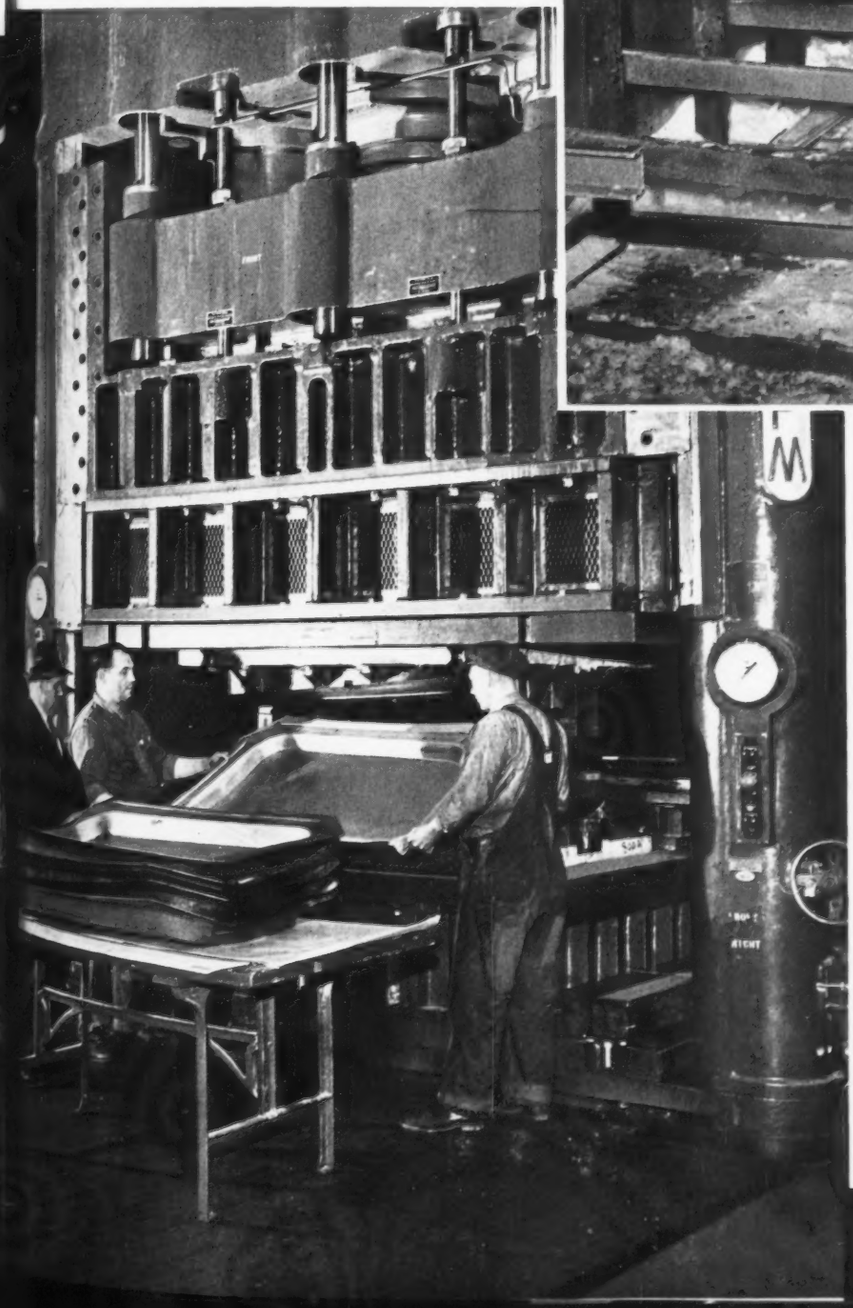

Fig. 18. An HPM Power Press of 300 Tons Capacity, Engaged in Forming Panels through the Use of a Blank-holder and a Double Press Action

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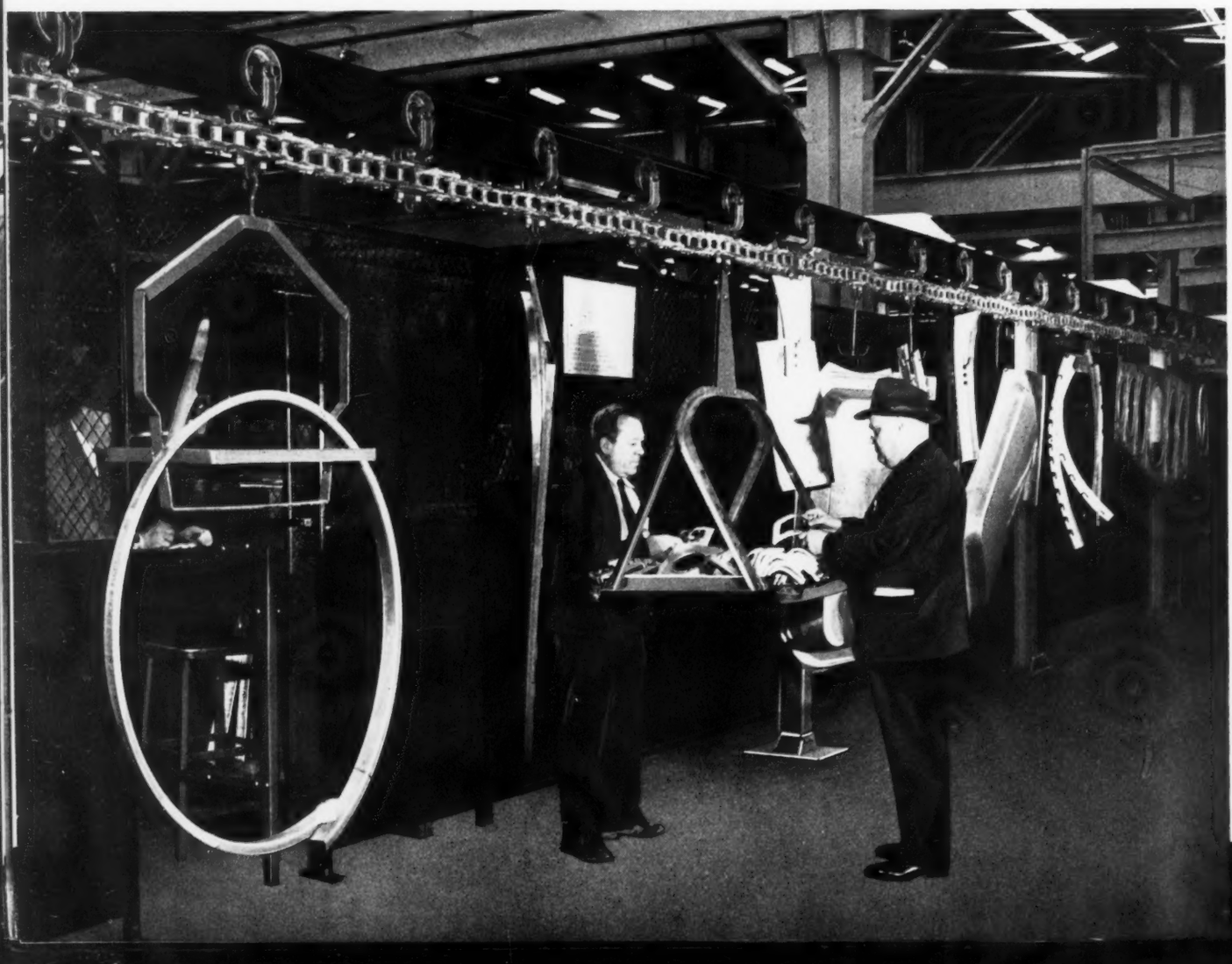
barrels revolve continuously at a slow rate during their entire passage around this equipment.

As spot-welding is being applied to a wider extent than heretofore in the fabrication of airplane sections, the welding department is unusually extensive. One of the most interesting machines is the Sciaky spot-welding machine illustrated in Fig. 23, which is believed to be the largest in the world used on aluminum alloys. The illustration shows this machine being employed in welding a bulkhead structure from two pieces of 5/32-inch thick aluminum alloy. The average shearing strength per spot produced by this machine is 3500 pounds, although spots with a shearing strength as great as 4000 pounds can be obtained. The spots are approximately 9/16 inch in diameter. Sixteen hundred kilowatts are obtained at the welding points from a line current of 160 kilowatts. The pressure exerted on the tips during the welding operation is 14,000 pounds. The upper electrode of the machine is moved up and down pneumatically.

Skin is spot-welded to corrugated sections by the Taylor-Winfield "Hi-Wave" machine shown in Fig. 22 to produce bomb bay doors. Fasteners are used to attach the skin to the corrugated sheets prior to the operation. These fasteners are removed by the helper as the operation proceeds. More than 1300 spot-welds are made on one of these doors. A considerable number of spot-welders in the same department are connected to refrigerating units to keep the electrode-holders cool under their intensive use.

There are many unusual tooling set-ups in the machine shops. For example, Fig. 25 illustrates a LeBlond heavy-duty engine lathe being employed for turning a groove around one end of the turret track for a rear gun. These aluminum-alloy tracks must not be out of round more than 0.010 inch in their entire diameter of 3 1/2 feet. The turret track is slipped around the periphery of a special faceplate, and a dial indicator mounted on the compound rest is brought into contact with one side of the groove as the

Fig. 19. Overhead Conveyor of the Type Employed for Carrying Parts of Large Variety from Manufacturing and Storage Rooms to Sub-assembly Departments



work is slowly revolved. In this manner, the amount and location of eccentricity can readily be detected. Jaws attached to slides equipped with Federal dial indicators are then adjusted radially against the inside of the turret track until true concentricity is obtained.

A square-nosed tool mounted at right angles to the faceplate is employed for turning the groove to the specified width within a tolerance of 0.010 inch and to the required depth. The tool is ground to produce fillets at the bottom corners of the groove.

In Fig. 24 is shown an American radial drilling machine equipped with jigs for drilling wing splice plates, this method insuring complete interchangeability of an important detail in aircraft construction. The jigs are of trunnion design, and are located on opposite sides of the large circular floor-plate, so that one jig can be loaded while parts are being drilled in the second jig. The work is clamped to the under side of the jig, with the jig swiveled to a convenient loading position, and then the jig is locked in the working position as shown. A long splice plate, such as seen lying on the jig base, and two shorter ones are clamped at one time on the jig. Thirty-seven holes are drilled in the large piece, and seventeen and twenty-three holes, respectively, in the small pieces. The holes are 3/8 and 1/2 inch in diameter, and must pass a plug-gage inspection. Four jigs enable twelve different pieces to be drilled.

Prior to the drilling operation, these aluminum-alloy splice plates are milled along one of the legs to the required thickness. This operation is performed on U.S. Multi-Millers equipped with jigs shaped to suit the contour of the work, as seen in Fig. 26. The arbor on which the two milling cutters are mounted is raised and lowered automatically as the table feeds longitudinally past the cutters. This is accomplished by a roller on the arbor engaging a cam at the back of the fixture.

Fig. 28 shows a Cleveland 1 3/8-inch auto-

Fig. 20. Millions of Rivets are Turned out Daily in This Department by Cold-heading Machines, of which One Row Only is Seen in This Illustration

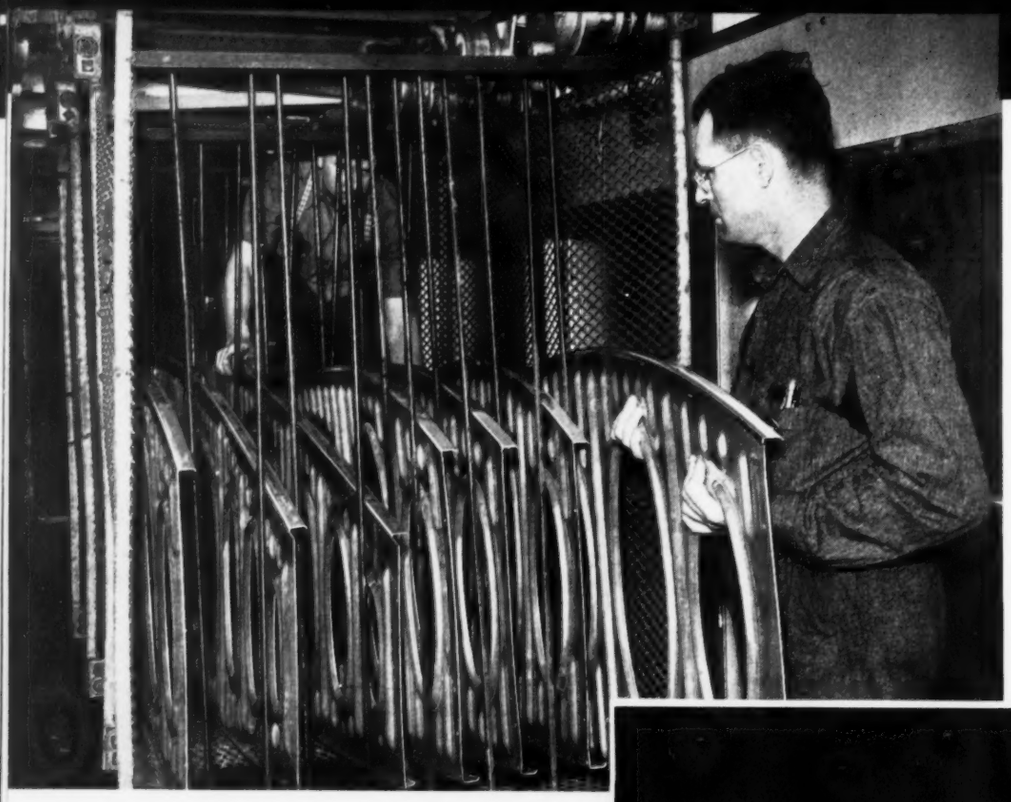


Fig. 21. Loading Bulkhead Structural Members on a Rack for Passage through a Continuous Heat-treating Furnace

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Fig. 22. More than 1300 Spot-welds are Made in Attaching Aluminum Skin to Corrugated Sheets in the Fabrication of Bomb Bay Doors

★

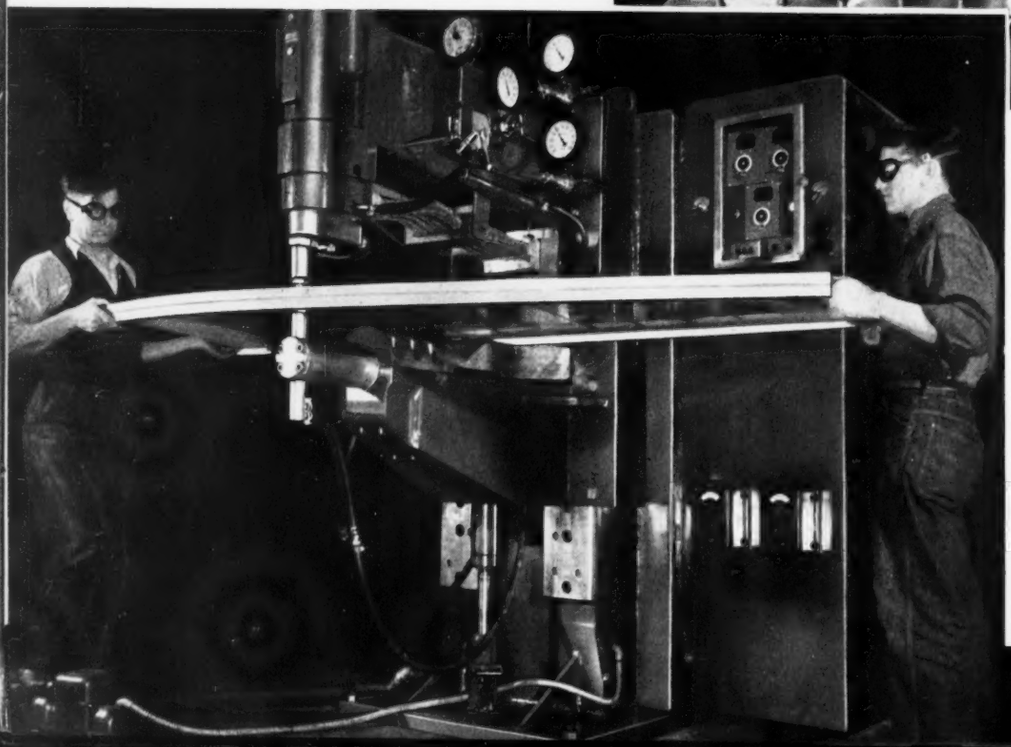


Fig. 23. Spot-welding a Bulkhead Structure on a Machine that is Believed to be the Largest Spot-welder in the World Used on Aluminum Alloys

★

Fig. 24. Radial Drilling Machine Set up with Jigs to Insure Accurate Drilling of Wing Splice Plates

★

Fig. 25. Turning Groove in a Large-diameter Aluminum-alloy Ring to Close Concentricity by Use of Dial-equipped Faceplate Jaws

★

Fig. 26. Milling Curved Splice Plates along One Leg in an Operation in which the Rise and Fall of the Cutters is Controlled by a Long Cam at Rear of Fixture

★

Fig. 27. Automatic Machine which Carries All Rivets and Some Other Small Aluminum Parts Successively through the Various Steps Required in the Alroking Corrosion-preventive Process

matic, which is one of a large number of automatics and turret lathes used in this plant. The operation illustrated consists of producing bushings from solid chromium-molybdenum steel stock. In the operating cycle, the stock is first fed forward to a stop on the tool turret and clamped. Then, successively, a 13/16-inch drill is fed into the stock to a somewhat greater depth than the length of the finished piece, a rough-boring tool is advanced to increase the diameter of the drilled hole, and a second boring tool comes forward to finish this hole, all of these tools being mounted on the turret. Next, a tool at the back of the cross-slide is advanced to chamfer the piece at the point where cutting-off is to occur, the tool having a double chamfer, so that the end of the stock remaining after cutting-off occurs is also chamfered. Finally, a parting tool on the front of the cross-slide cuts off the finished piece.

Fig. 29 shows an operation on a Warner & Swasey turret lathe, in which a drill mounted on the hexagon turret first cuts a hole through a small aluminum forging, after which boring cuts are taken by means of several tools mounted on the square turret. The part is held in a pot type chuck of a swiveling design that enables quick reloading.

Girls are widely employed throughout the machine shop, as well as along sub-assembly lines and final assembly conveyors, in welding departments, etc., and it is expected that more and more girls will be employed as male help becomes scarcer. Fig. 30 shows three girls engaged in drilling small parts on a Footburt six-spindle gang drilling machine.

★

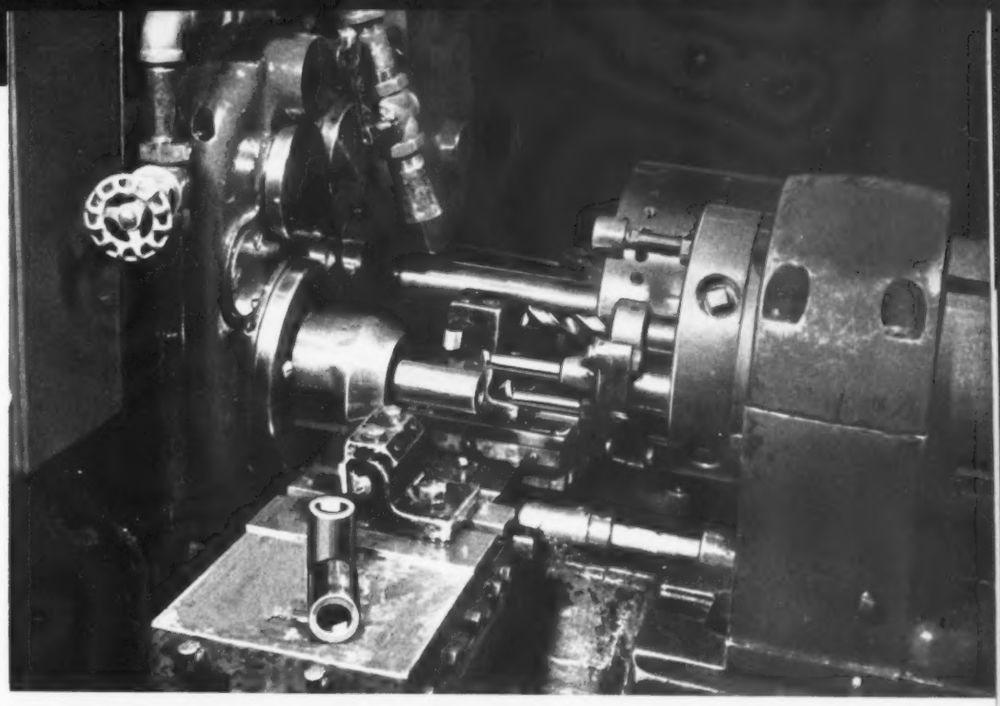


Fig. 28. Typical Operation on an Automatic in which Bushings are Made from Chromium-molybdenum Bar Stock

★

Fig. 29. Turret Lathe Set up for the Accurate Drilling and Boring of a Hole in Small Aluminum-alloy Forgings

★

Fig. 30. Sensitive Drilling Operations being Performed by Three Girls on a Six-spindle Gang Drilling Machine

HAVE YOU AN IDEA FOR UNCLE SAM?

★ The vaunted Hitler brand of intuition hasn't been doing so well lately. Among other things it has collided with the incredible ability of inventive people to do the impossible, and that has been upsetting. The Hitler intuition failed to take into account the difference between the accomplishments of a free people and the regimented results to be had from an economy of compulsion.

★ The power of industrial America has already gone into action all along the fighting front from Leningrad to Africa and in the Pacific. That this has been done at a speed Axis leaders had supposed to be impossible is due to the imagination, daring, and ingenuity that have invented ways and means of doing things as they had never been done before and doing them better as well as faster. It is to retain the right to think for ourselves and act for ourselves that we are fighting this war, and it is because we have maintained these rights and exercised them vigorously that we can now begin to see a turn in the war tide. The job done at home is beginning to make itself felt at the front.

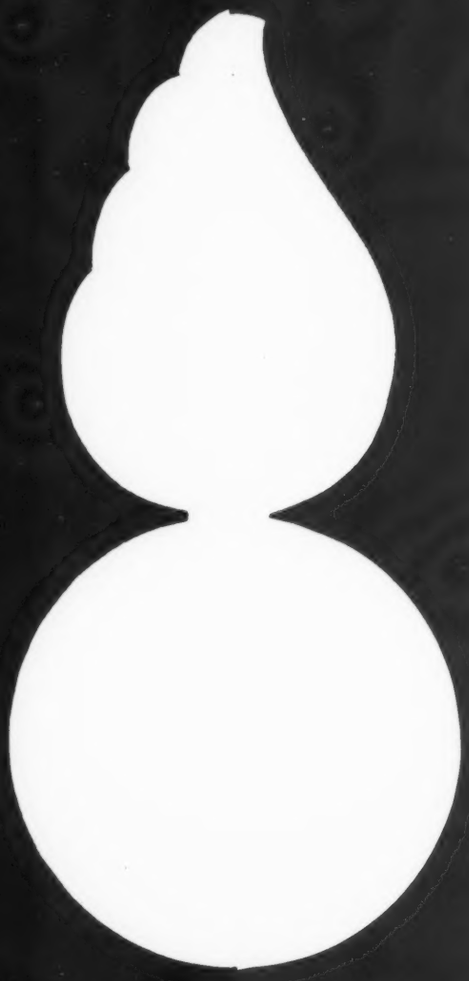
★ The war industries are confronted with many problems, but none more important than the conservation of critical materials. It is quite a trick to produce more out of less, but the pace of our whole war effort depends largely on our success in solving that very problem. Remarkable things have already been accomplished by the Ordnance Department and industry working in fine cooperation. In December MACHINERY we published the brochure "Metalurgency," which contained numerous examples of where and how substantial savings in critical materials had been effected. The following pages furnish other interesting examples of similar achievements, and give well deserved credit to the men who developed the new and ingenious designs that made these savings possible.

★ MACHINERY is glad to give active support to this excellent program of the Ordnance Department. Much has already been done; more still remains to be accomplished if we are to give the men at the fighting front what they need. War production will speed victory, and ideas will speed war production. Have you an idea for Uncle Sam?

R. S. Tucker

Publisher

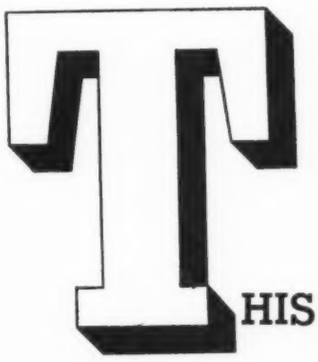
BATTLENECKS



Army Ordnance

US

"America must win this war. Therefore I will work; I will save; I will sacrifice; I will endure; I will fight cheerfully and do my utmost, as if the cause of the whole struggle depended on ME alone."



HIS pledge was found in the pocket of a young American soldier killed in battle in 1918. I commend it to every soldier on the production front, whether he wears a uniform or not.

L. H. CAMPBELL, JR.
MAJOR GENERAL, CHIEF OF ORDNANCE

BATTLENECKS

STOP CALLING THEM BOTTLENECKS. THEY ARE BATTLENECKS

- When you cannot get enough brass to make the shell cases needed for the battle plan, brass isn't a bottleneck, it is a Battleneck.
- When there isn't enough aluminum to make the bombers wanted for a second front, it is a Battleneck.
- When you can't get delivery on machined parts and a gun assembly line stops, there is a Battleneck, not a bottleneck, because sailors and soldiers may die in battle for lack of them.
- When there isn't enough nickel, chromium, tin, or molybdenum for your specifications, you have a Battleneck, because the job we do here will determine the life or death on the battlefield of thousands of our fighting men.

FIGHTING WORDS on a FIGHTING FRONT

"Bottleneck" is a passive peacetime word, meaning only a restricted flow of material. In war it means an increased flow of blood. In this all-out war, we need more fighting words and fighting deeds on the production front. "Battleneck" is a fighting word and the man or woman who helps eliminate one is performing a fighting deed, because he is fighting for the lives of others.

It is going to take a great many production front fighting deeds to win this war in a reasonable time, and the purpose of this booklet and "Tremendous Trifles" and "Metalurgency" that preceded it, is to further the Design and Engineering Offensive that must get under way before our second, third, fourth, and tenth war fronts will have the support they need.

THIS IS YOUR WAR . . . FIGHT IT!

To the man at the war front, be it on land or sea, there is no doubt that this is his war and that he has to fight it. It is a matter of life or death to him.

Here at home, however, out of sight and sound of battle, there is no bayonet, bullet, bomb, or blood to stir us to action. We cannot see or feel the forces that would destroy us, but they are here, lurking in the Battlenecks that threaten our ability to deliver enough, on time, to the many places where a pound of steel can save a pound of flesh and blood --possibly your own.

THIS IS YOUR WAR-FIGHT IT!

BATTLENECKS DEFINED

•

1 Material

The material specifications of our present production require our entire flow of copper, nickel, tin, chromium, aluminum, etc. In order to increase our production 50% to 100% as needed, we must take enough scarce materials out of these specifications to provide for the increase. We must create a supply by saving.

2 Machines

Manufacturing specifications for our present production are using our machining, forging, and casting equipment to capacity. To increase our production 50% to 100% as needed, we must redesign a great portion of our war equipment for manufacture on now idle machines.

3 Men

Designers and engineers, in uniform and out, are working on these problems to the limit of their physical ability and are making progress. To do this job, involving thousands of items, will require the time and talents of thousands of additional skilled men, because this is the most gigantic redesign and conversion program that the world has ever seen.

Designers, Engineers, Chemists, Mechanics,—here is your call to arms.

THIS IS YOUR WAR-FIGHT IT!

CITATIONS

This Production Front War on Battlenecks has been going on for months with marked success. "Tremendous Trifles" and "Metalurgency", the two previous Dispatches from this front, have cited the exploits of a number of "fighting" men in eliminating Battlenecks.

These preliminary actions have definitely turned the tide, but the job that remains to be done closely resembles and must precede the task of our forces in the field. Methodical and heroic action is yet required on both production and battle fronts.

This third Dispatch cites the accomplishments of additional Production Front Fighters and points out how each has contributed to the elimination of a Battleneck.

This Is Your War--Fight It!

ORDNANCE DEPARTMENT

Citation

UNITED STATES ARMY

makes it known

HAS RENDERED DISTINGUISHED SERVICE TO HIS COUNTRY IN THE STRUGGLE TO MAINTAIN THE FREEDOM OF ALL PEOPLE. BY THE EXERCISE OF HIS INITIATIVE AND INGENUITY HE HAS MADE A MARKED CONTRIBUTION TO THE VITAL WAR PRODUCTION PROGRAM TO CONSERVE CRITICAL MATERIAL AND MACHINES.

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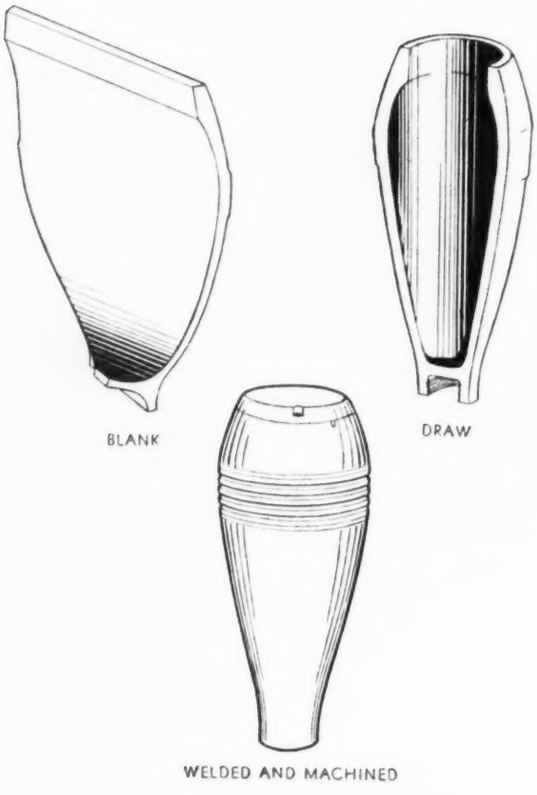
Tremendous Trifles No. 34

CITING:

MR. THOS. E. MURRAY

MORTAR SHELL



—for designing a mass production 81-mm. Mortar Shell to replace the model made by machining and hogging out a forging.

Now a steel section is rolled, blanked out, and drawn; and two identical pieces are welded together and machined, with a saving for other uses of 12,000,000 lbs. of steel* and 750,000 machine hours on the present procurement.

*STEEL ENOUGH for

3 SUBMARINES

and

ONE DESTROYER

THIS IS YOUR WAR - FIGHT IT!

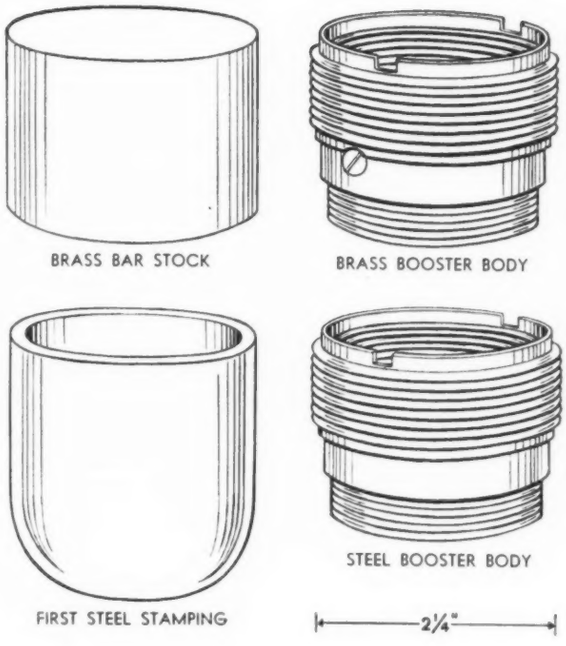
Tremendous Trifles No. 35

CITING:

LT. COL. D. L. WOODBERRY

MR. CHARLES H. GODSCHALL

BOOSTER BODY

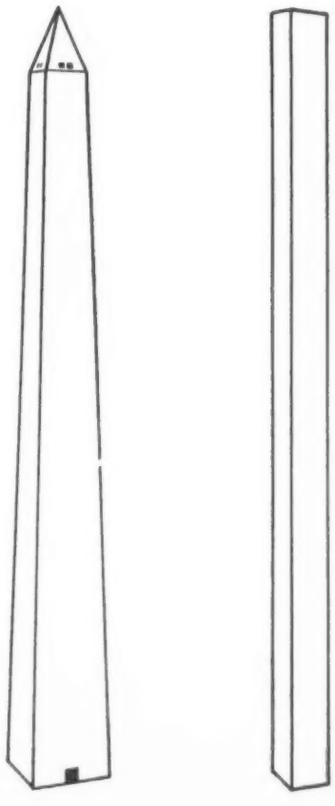


—for a design to save 166,000,000 pounds of Brass on the present procurement of M-20A1 Booster Bodies.

This would be the equivalent of a column of Brass 24 ft. square as high as the Washington Monument.

It has been redesigned in three parts instead of two, to be stamped from steel.

Engineering is under way on a design to permit malleable iron castings as an alternate.



THIS IS YOUR WAR . . . FIGHT IT!

Tremendous Trifles No. 36

CITING:

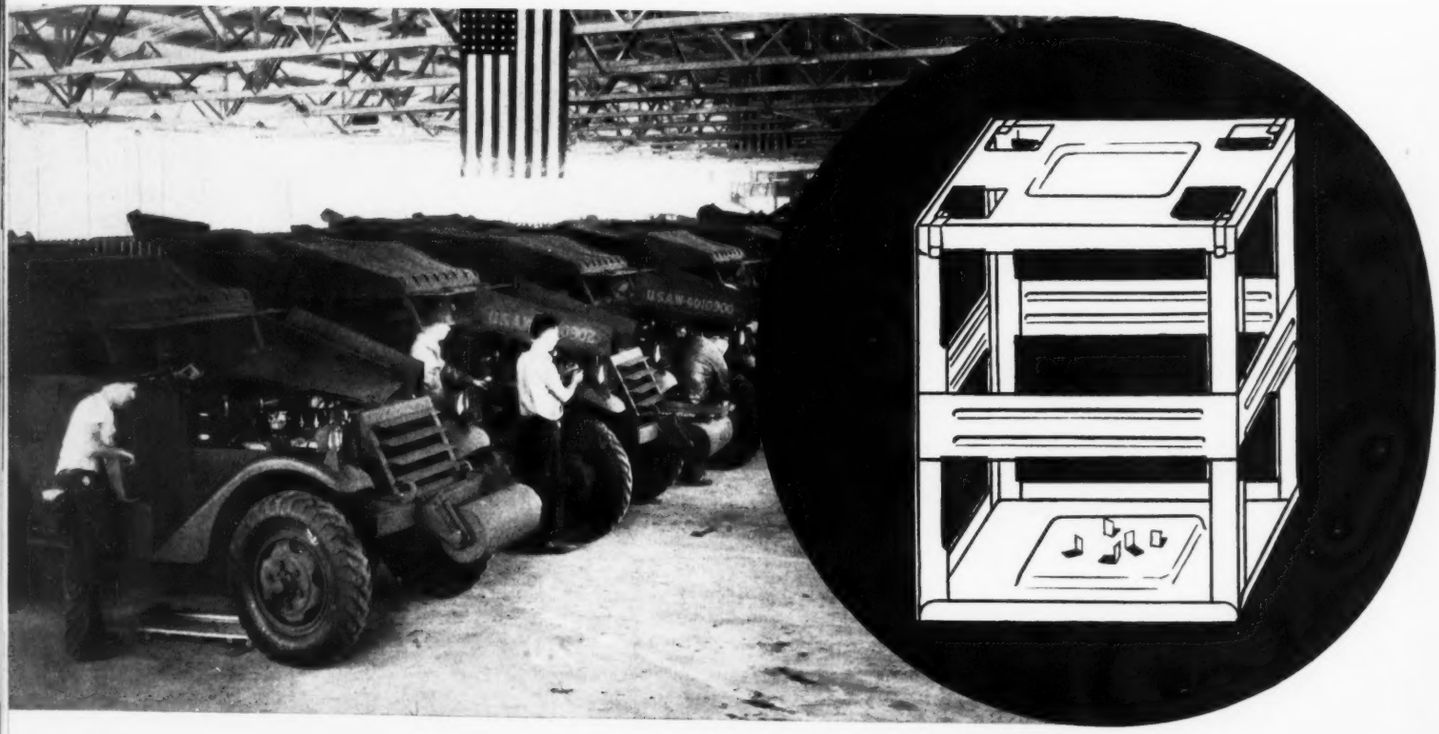
MAJ. A. R. DAVIS
CAPT. C. SCANTLEBURY
MR. G. E. PARKER
MR. F. D. HAYES

BOMB FIN CRATE

— The next million 500 pound Bombs that go crashing down on Germans or Japs will leave behind them 5,790,000 pounds of unused steel because they redesigned the crate that carries this Bomb Tail Fin.

<u>This is enough steel to make 413 Half Track Armored Cars.</u>

The saving was accomplished by using smaller and thinner members in some cases, ribbing others, and replacing an accessory holder by embossing the top and bottom plates.



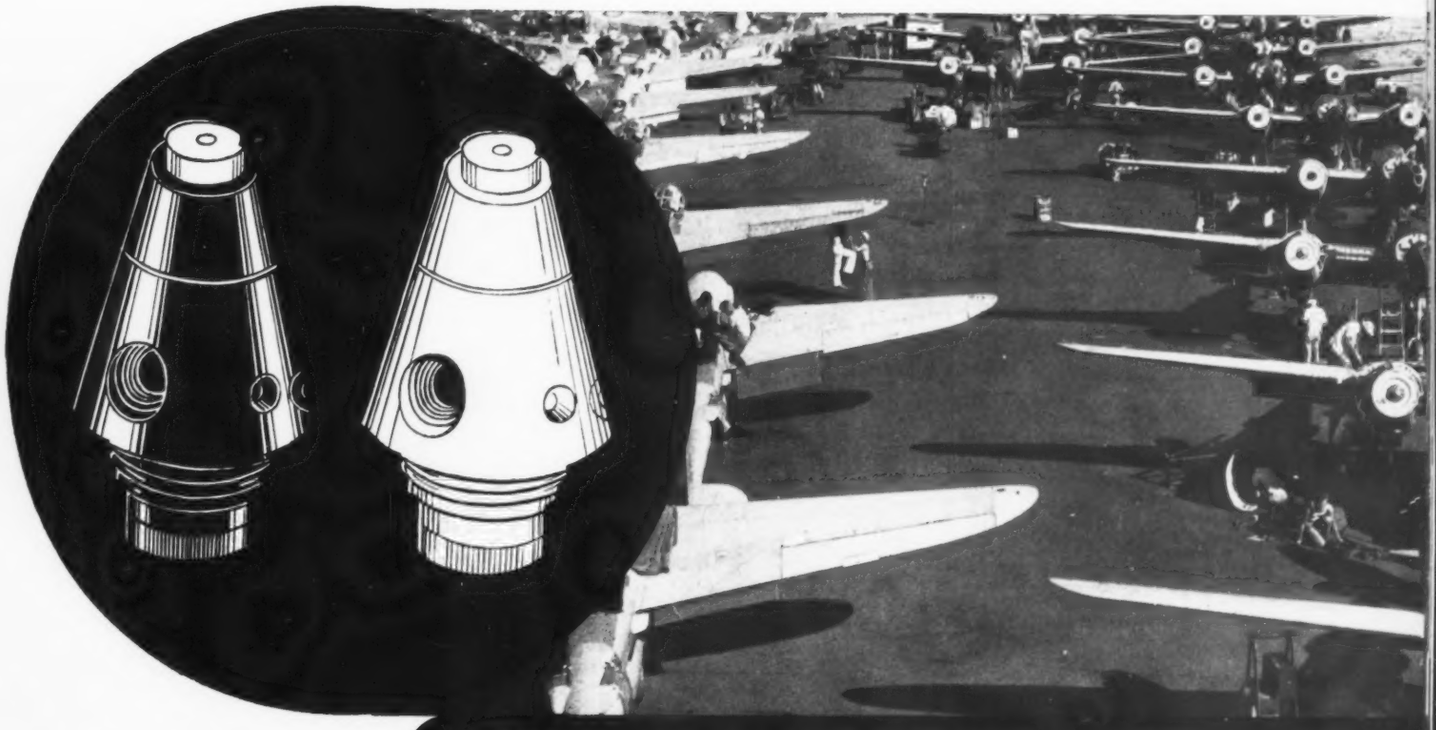
Tremendous Trifles No. 37

CITING:
MR. H. A. HUSTED
MR. F. H. SHAW

PLASTIC FUZE

They are cited for developing a plastic fuze body to replace critical Aluminum. Now, every time one of these shells go screaming at a Japanazi, there is one pound of Aluminum remaining here for airplane construction. In addition, non-critical molding replaces critical machining.

<u>One million plastic fuzes will save enough Aluminum to build 270 Fighter Planes.</u>



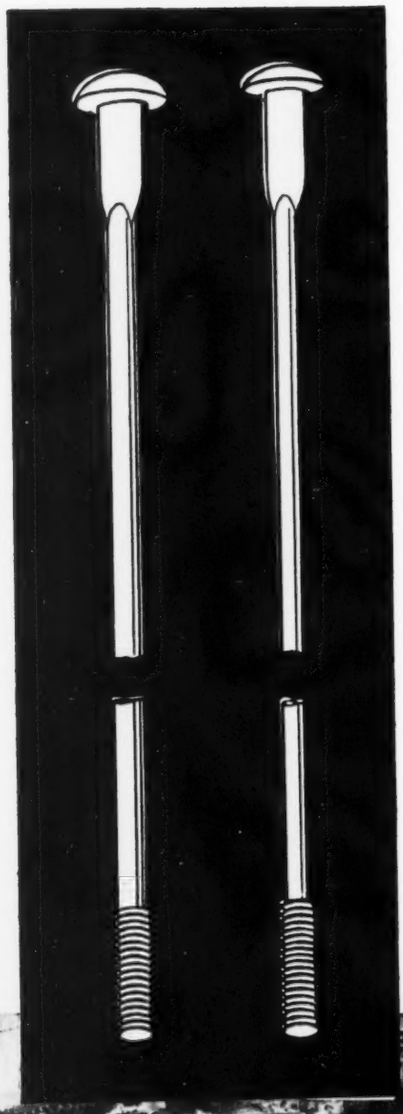
THIS IS YOUR WAR - FIGHT IT!

Tremendous Trifles No. 38

CITING:

MAJ. V. L. BRADFORD

BUNDLING WIRE



He remembered that a chain is only as strong as its weakest link. Therefore why make a Bundling Wire thicker than the inside diameter of the threads on its end.

Now, by reducing the diameter and because the threads are rolled on, we eliminate thread cutting, get a stronger thread, and gain 7,000,000 pounds of steel—enough for 100 M-4 Tanks, up to January first 1943.

Tremendous Trifles No. 39

CITING:

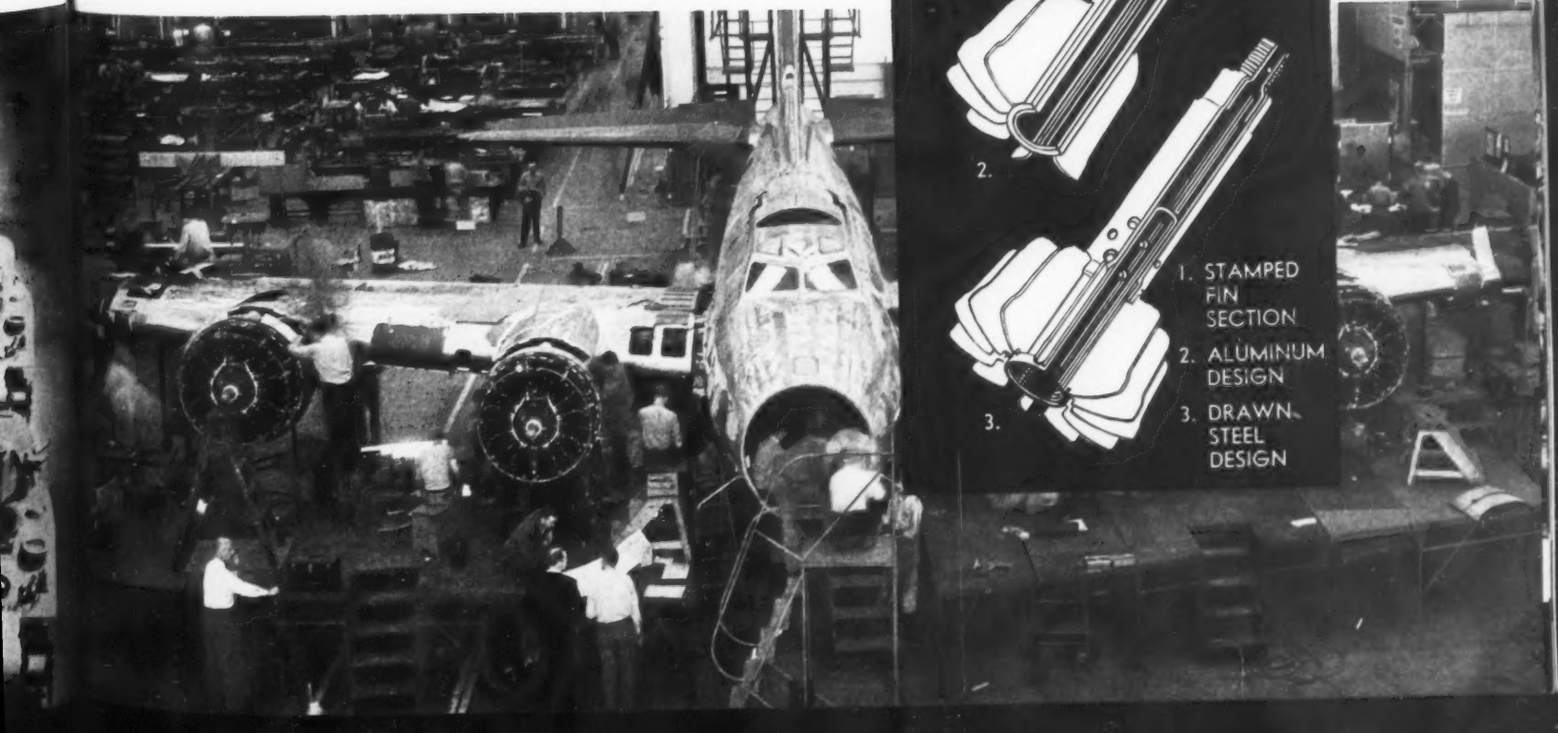
LT. COL. C. M. ROBERTS

MR. DANIEL DEWEY

MORTAR SHELL TAIL FIN

This redesign affected three critical situations—Aluminum, Die Casting and Screw Machines. All three of these Battlenecks were widened by designing this 81-mm. Mortar Shell Tail Fin to be made from drawn steel cups and formed steel stampings, instead of from cast Aluminum with a machined steel core.

When our present procurement of these Tail Fins is completed, there will be Aluminum saved for 100 Four Motored Bombers.



Tremendous Trifles No. 40

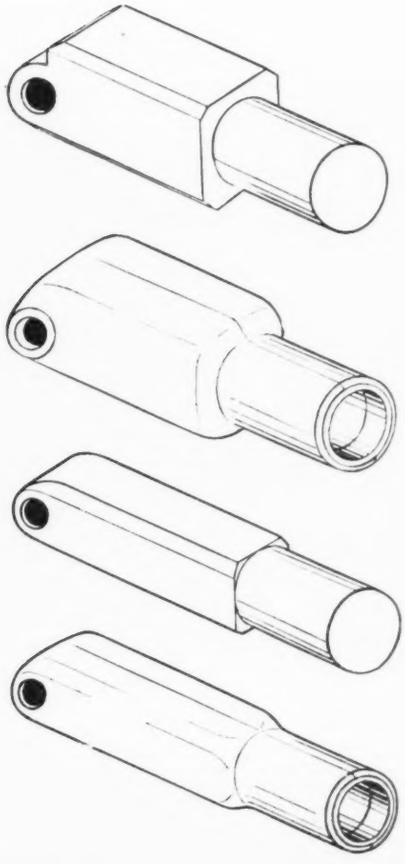
CITING:

1st LT. HOWARD WOLF

TRIPOD HINGES

Every Machine Gun Tripod has three hinges. In peacetime, the few needed were machined from solid forgings. For the remainder of our war, thanks to him, they are going to be made by welding two stampings together.

Small as these parts are, the Battleneck Breaking results are that on the next ten thousand tripods enough steel will be saved to make 640 Calibre .30 Machine Guns.



Tremendous Trifles No. 41

CITING:

CAPT. D. M. BACHELOR

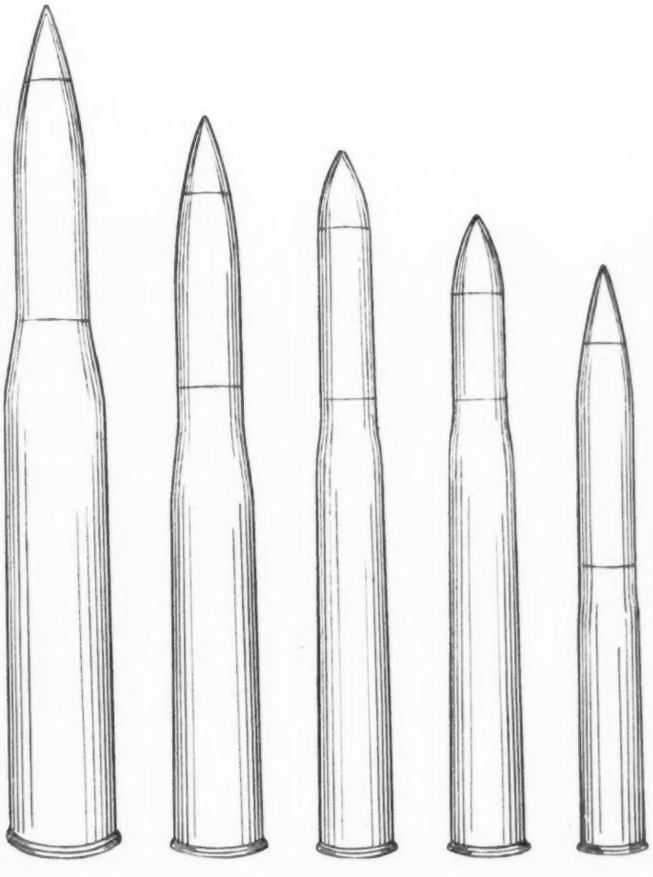
MR. FRANK SHUMANN

DRILL CARTRIDGES

—for saving 1,386,307 pounds of Copper, 467,752 pounds of Zinc, 102,675 pounds of Aluminum and 73,616 pounds of Manganese, and 9,150 pounds of Tin.

This was accomplished on the present procurement by converting 75 mm., 3-inch, 90 mm. and 105 mm. Drill Rounds (Dummy Practice Cartridges) from Manganese Bronze Castings to Malleable Iron Castings.

This is enough copper for 50,996,-097 Caliber .30 Cartridge Cases and points the way to tremendous savings in non-expendable material.



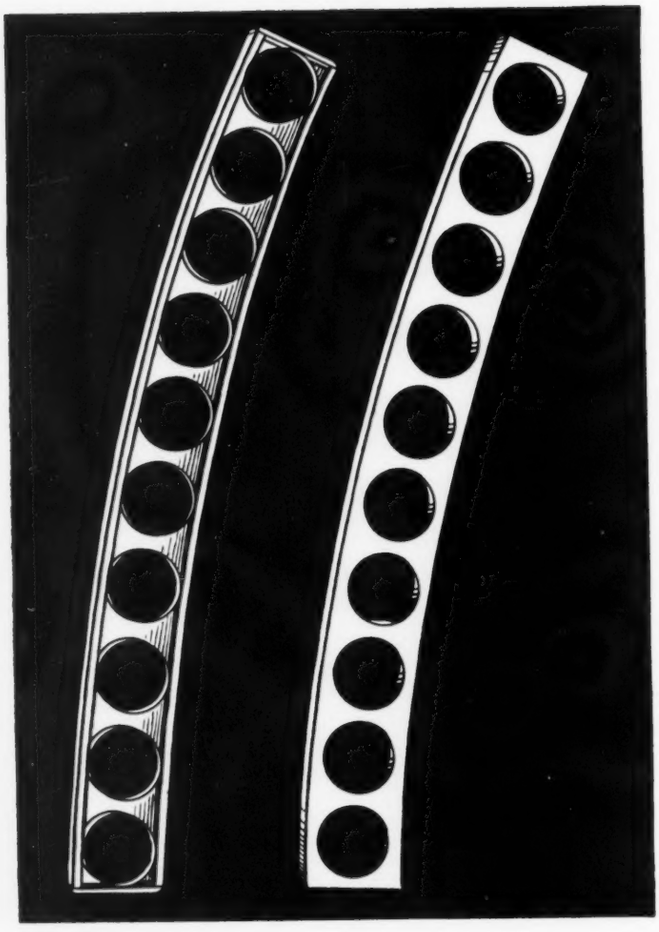
THIS IS YOUR WAR - FIGHT IT!

Tremendous Trifles No. 42

CITING:

MR. J. E. ECKENRODE

BALL RETAINER RING



Lessons learned in the mass production of roller skates, bicycles, and automobiles, have been applied to M-4 Tank design, not only to save critical materials, but to increase tank effectiveness.

200,000 Ball Retainer Sections converted from machined cast bronze to simple formed stampings saves 400,000* pounds of this scarce metal.

***ENOUGH COPPER FOR THE ROTATING BANDS ON 177,000 SHELLS**

Tremendous Trifles No. 43

CITING:

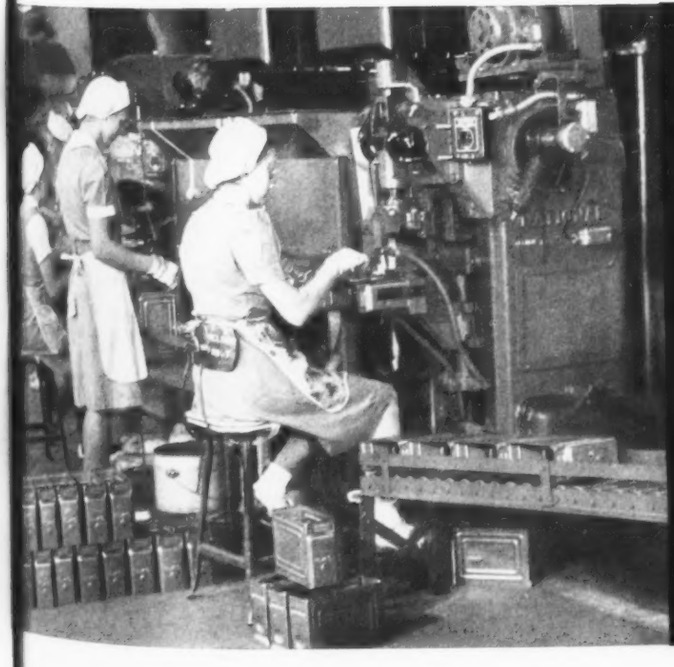
CAPT. F. G. BRENNER

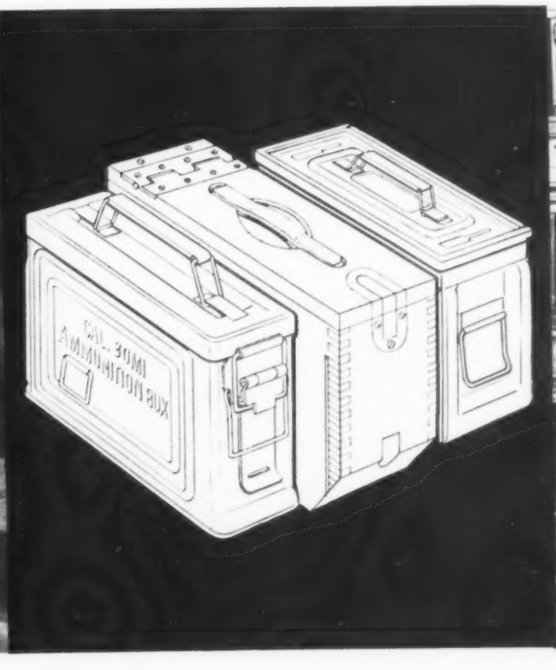
AMMUNITION CHEST

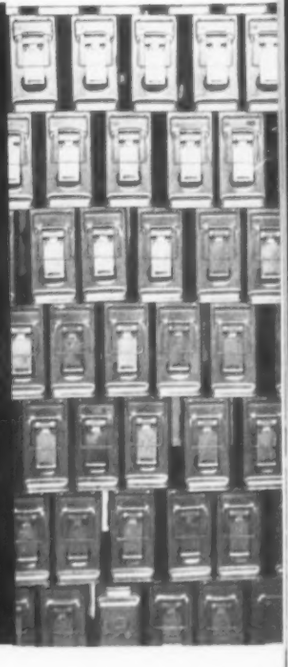
Tactical requirements of mobile warfare, that ammunition chests be expendable, moistureproof, non-inflammable, and extremely rugged, have forced a change from wood to steel. Such boxes for calibre .30 and calibre .50 ammunition have been put into production and are being loaded prior to issue to troops.

This citation is for a design program that has reduced storage and transportation requirements 32% on the .30 calibre ammunition box. Making the calibre .50 ammunition box from several rectangular blanks instead of one cross-shaped blank saves enough steel per million chests to make 500,000 calibre .30 boxes.

An alternative calibre .50 box design permits seam welding and thus opens up additional manufacturing facilities.







THIS IS YOUR WAR . . . FIGHT IT!

Tremendous Trifles No. 44

CITING:

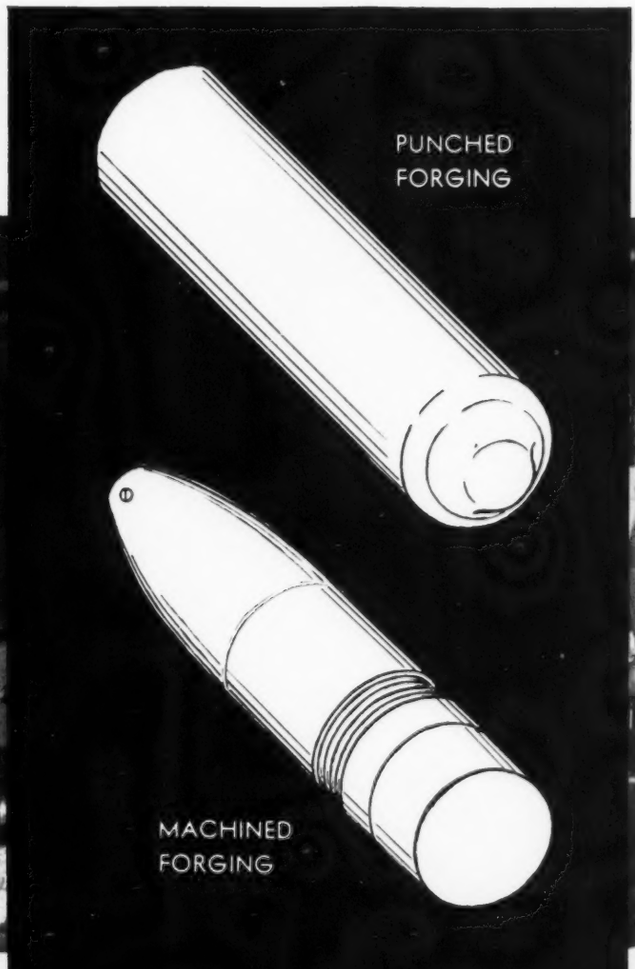
MR. WALTER W. HOWLEY

INTEGRATING COMMITTEE

REDUCED BILLET WEIGHT

For pioneering the reduction of billet weight in shell forgings and the idea of using forging weight as a guide in conservation. This has resulted in the reduction of the specification maximum from 54 to 42 pounds on the 105 mm. shell.

Using the square billet, punch and draw method, the Gadsen Ordnance Plant has, over a period of time, reduced the billet weight to 40 pounds. By close control of operations such as uniform heating, rolling to accurate diagonals and concentric piercing and drawing, 12,000,000 pounds of steel are saved per million shells.

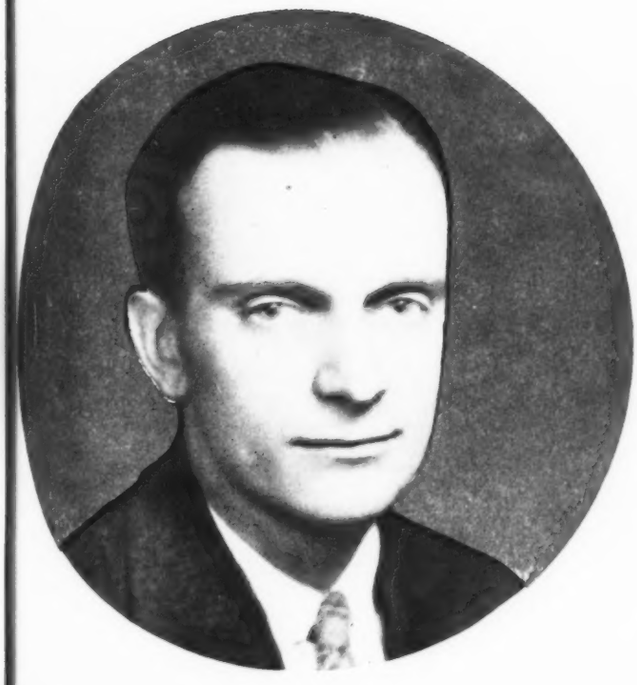


Tremendous Trifles No. 45

CITING:

MR. THORNE PENDLETON

HOT PRESSED SHOT

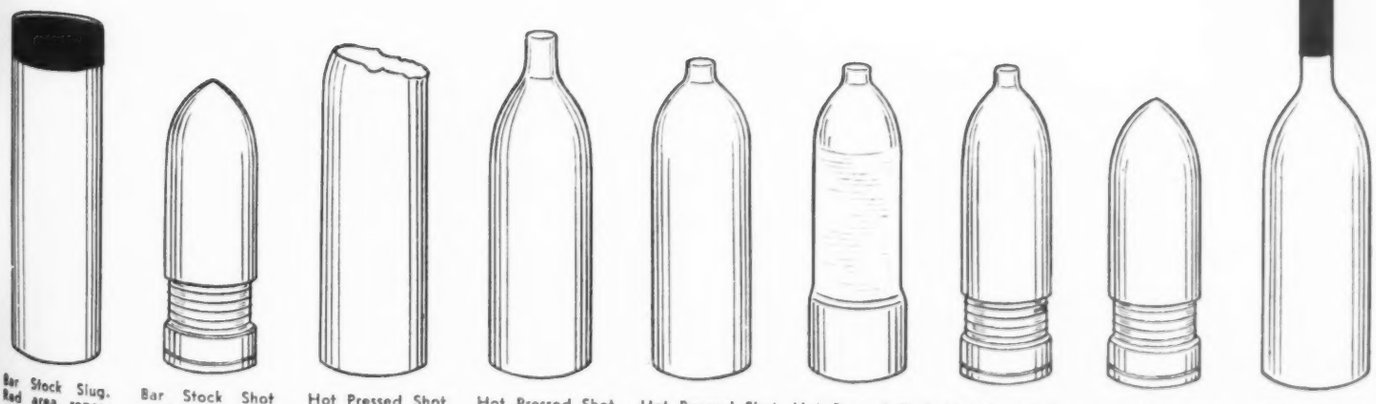


The conventional method of making Armor Piercing Shot is by machining from bar stock.

This manufacturer saves ¾ pound of high alloy steel per 37 mm. shot by hot pressing a sheared billet before machining. Now we can produce three Shot from the same amount of Bar Stock which provided only two before.

This development will undoubtedly enable Integrating Committees to extend the benefits of this idea widely.

3 SHOT for 2 from SAME AMOUNT of STEEL



Bar Stock Slug. Red area represents waste metal compared to #3.

Bar Stock Shot ready for centerless grinding.

Hot Pressed Shot Slug sheared.

Hot Pressed Shot Slug after hot pressing.

Hot Pressed Shot Slug after annealing, cleaned and tip cut off.

Hot Pressed Shot Slug chucked and turned to band groove.

Hot Pressed Shot Slug ready for final machining.

Finished Hot Pressed Shot.

Red area shows saving by Hot Pressing.

THIS IS YOUR WAR . . . FIGHT IT!

Where To Find BATTLENECKS

There are thousands of points where you can attack "Battlenecks" and just remember this: American Engineers have never failed to improve on a product, no matter how good it was when they started to work on it. Witness the annual improvements in our automobiles, refrigerators, washing machines, oil burners, sewing machines, locomotives, airplanes, radios, farm machinery, road machinery, or almost anything else that can be mentioned.

THE SKY IS THE LIMIT

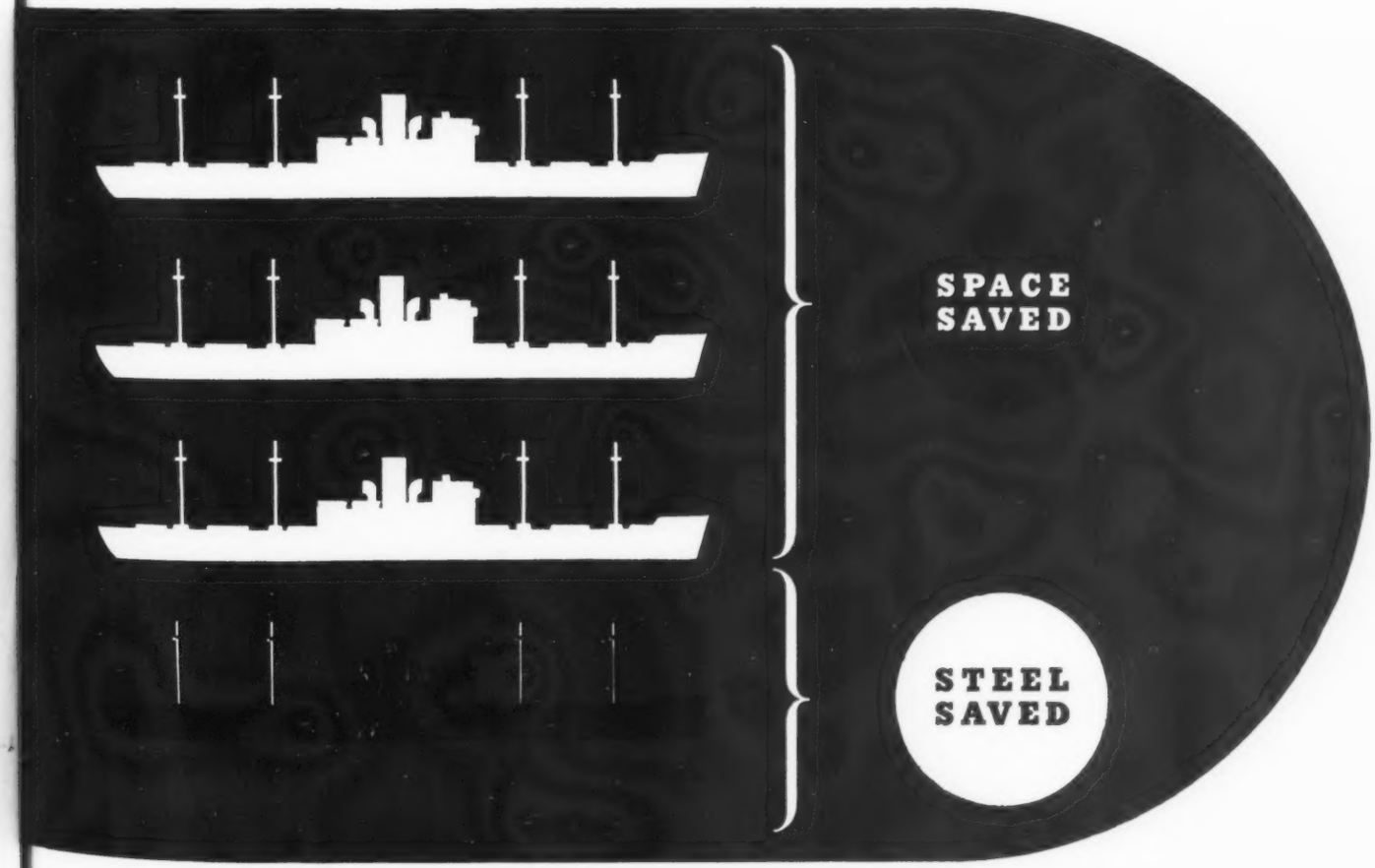
But to get a full appreciation of the job to be done and that can be done, our thinking should go beyond the 45 examples that have been presented in this series of booklets. In truth, the sky is the limit. New fields open up daily, and the old fields are all subject to review.

Take a look at the following which are a few of the things that are challenging us today. Some of these challenges have already been accepted and are being worked on. Others remain to be taken up by volunteer Production Front Fighters. Take your choice. There are enough for everyone.

CREATE SHIPS

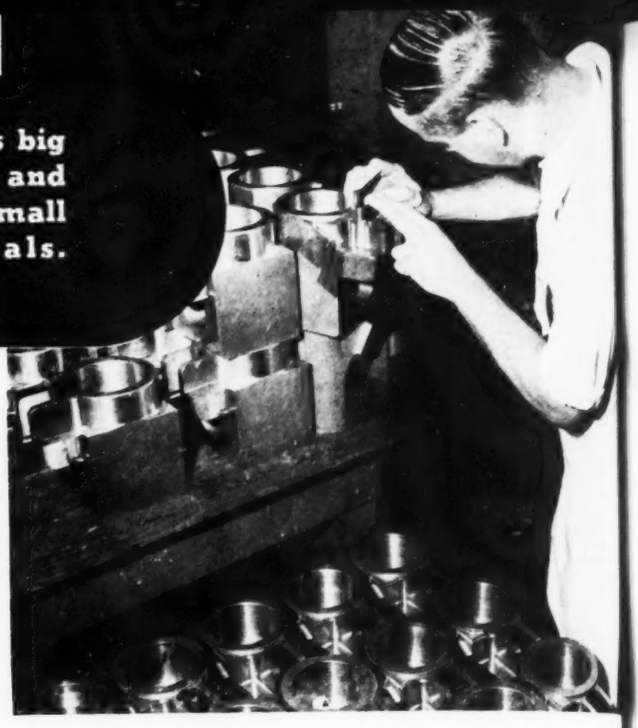
Redesign the 500 pound Bomb Fin to fold flat and be easily assembled overseas. On the next million, because the crate would be practically eliminated, three new Liberty Ships will be literally created out of thin air by the saving in space.

The steel saved by eliminating the present crate will be enough to build another ship. This is a challenge worthy of the efforts of any Production Front Fighter.



THIS IS YOUR WAR - FIGHT IT!

There are other Production Enemies just as big or bigger than the Bomb Fin and Crate and there are thousands more which seem small but which add up to tremendous totals. Here are a few:



Physical Requirements:

How many specifications show physical requirements that force the use of high alloy steels, but really aren't necessary? Here are literally new mines of alloying metals.

Substitution:

If fibre can replace aluminum in field map cases, why can't the same kind of thing be done in other cases and metals thus provided for airplane wings and food containers? What about malleable iron to replace more brass and aluminum castings?

Tank Tracks:

We probably have the best tank track in the world, even if we did have to give up rubber. But it isn't good enough. We should be able to redesign it so that it will give double the mileage. Fewer repairs and retracking will in effect put more tanks into action, and reduce the spare track requirements.

Armor Piercing Shot:

Thousands of tons of scarce alloying metals are used in Armor Piercing Shot. There are those who think even better shot can be made from carbon steel—better than the specially Tipped Projectiles.

Armor Plate:

Make Armor Plate of non-critical steel that will stop the best shells. Stop this terrific drain on our stock pile of nickel, chromium, molybdenum, etc.

Forging Operations:

Method X speeds gun barrel production and reduces billet weight to ⅓. Why cannot there be fewer forging operations and consequent billet savings in all shell manufacture?

Fuze Assemblies:

We know that some Fuze designs have been simplified and made of less critical materials. If enough people put their minds to the task, all Fuzes can get on the saving side.

Projectiles:

The 81 mm Mortar Shell is just a starter. Why cannot other projectile designs be made to show the same saving in material and machine hours?

Machine Operations:

Twenty-nine critical machine operations were replaced by seven non-critical operations in the 20 mm Cannon Trigger Cover Plate. Similar savings can be recorded by the man who redesigns the Calibre .30 Carbine Trigger Guard and a Machine Gun Receiver. The latter is at present being machined down to 5 pounds from a 23 pound forging.

Centrifugal Casting:

If centrifugal casting permits lower alloy steel in tank sprockets, what about other sprockets and gears? Millions of these trifles, saving only an ounce each would add up to appreciable tonnage.

Shipping Space:

To add to the shipping space saved by redesign of the Powder Box and the Ammunition Box is that of the Airplane Packing Case.

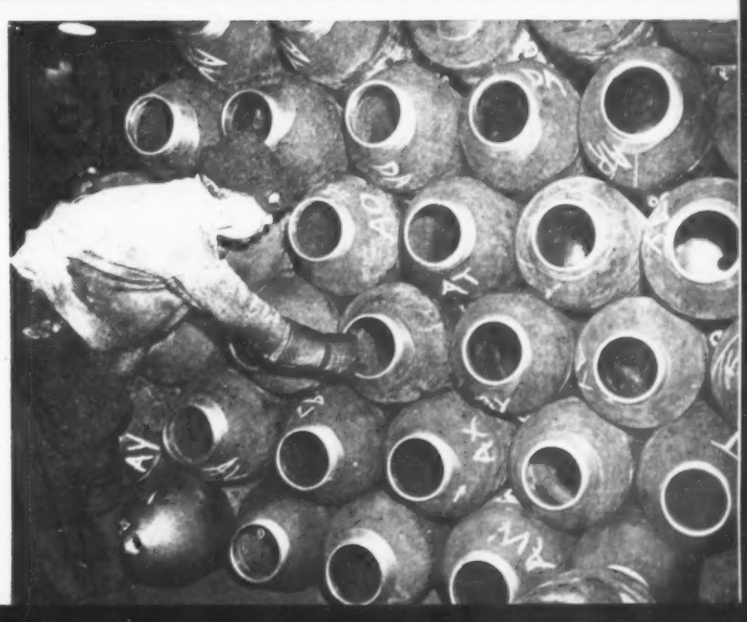
By redesigning this single crate into four separate crates, the total cubical content was cut 20%, but since smaller packages make possible better stowing, the effective saving is stepped up to 33⅓%.

This means that on the shipment across country and overseas of one month's airplane production, it is now possible to save the use of 2,500 flat cars and 14 standard cargo vessels.

This should challenge all to look critically at every container and packing case, because accomplishments of this kind are the equivalent of building new freight cars, factories and new shipyards out of sunshine and sand.

In other words, Soldier, there is a Battleneck in front of you wherever you are. All you have to do is to make up your mind that—

THIS IS YOUR WAR - FIGHT IT!



Tremendous Trifles

BATTLENECKS

FOR FURTHER INFORMATION

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MAJOR GENERAL T. J. HAYES

ORDNANCE DEPARTMENT

U. S ARMY

PENTAGON BUILDING

WASHINGTON, D. C.

OR

ANY ORDNANCE DISTRICT OFFICE

Getting More Production from Planers

By JOHN M. WALTER, Chief Engineer
G. A. Gray Co., Cincinnati, Ohio

Special Tools, Methods, and Equipment are Necessary to Fully Utilize the High Production Capacities of Modern Planers

HIGH production is an inherent quality built into modern metal planers. The table speeds of present-day planers are variable up to 240 feet per minute on both the cutting and return strokes. Smooth and fast reversals result in a minimum loss of time when the table reverses its direction of travel at the end of each stroke. Plenty of power is also available for even the heaviest cuts.

The heads, cross-rail, and uprights possess extreme rigidity. Feeds up to 1 inch, variable by small increments, are provided. Automatic tool-lifters, which prevent the tool from dragging on the work during the return stroke, serve to lengthen the tool life and increase the amount of work done between grinds. Accuracy of alignment and of surface bearings and fits, so necessary to uninterrupted maximum production, is in accordance with the highest degree of precision obtainable. These essentials, plus many other refinements, give the modern planer a production capacity offering great possibilities. To get maximum production from these machines, however, it is necessary to utilize all their qualities efficiently.

Some of the most effective methods of increasing planer output that the writer has observed in various shops over a period of years are described here.

A plentiful supply of sharpened cutting tools should be kept at the planer, where they are available to the operator at all times. The cost of the tools is so small a part of the total investment in the planer that to skimp on this item is economically unsound. Sharpening the tools should not be done by the operator. During the time the operator is engaged in sharpening or looking for tools, the planer will probably be standing idle. Also, new operators or men being trained to run the new planers or to work on the third shift have plenty to learn without trying to master the art of sharpening tools. The tools should be sharpened in the tool-room only, where a chart is available which shows the rake and clearance angles to which the tools should be ground.

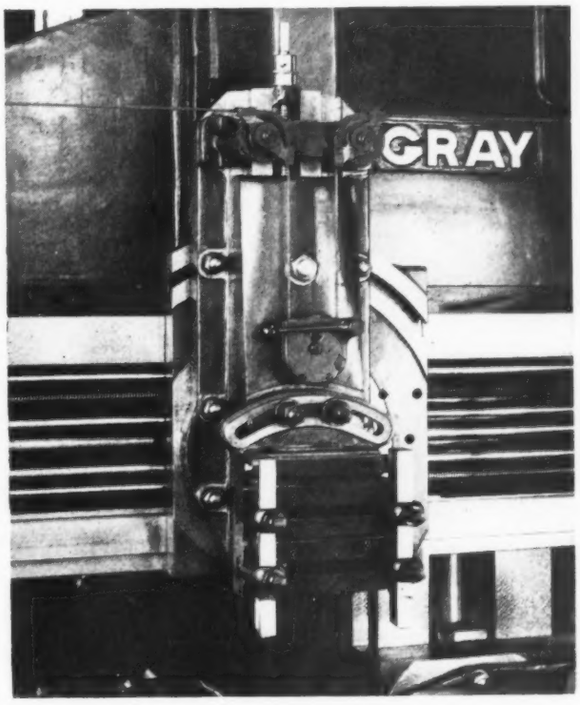


Fig. 1. Two Tools Mounted in One Rail-head for Planing a Flat Surface

Use of Tipped Tools

Tipped tools are now being used extensively on planers for work requiring cuts not deeper than 1/2 inch. Cutting speeds with these tools up to 225 feet per minute are used for cast iron in the lower hardness range. Finer feeds must be used with tipped tools than with high-speed steel tools. Tipped tools are particularly well adapted for jobs where the breaking away of the cast iron just as the tool approaches the end of the cut is to be avoided. They are also well suited for work having thin walls which would be likely to break under a heavy cut.

For heavy jobs that will support cuts of 1/2 inch or more in depth, high-speed steel tools can be used successfully. Heavy

feeds can be employed with these tools with satisfactory results as regards the amount of metal removed in a given time and tool life.

Advantages of Multiple Tooling

Large and medium-size planers are usually equipped with three or four heads. To get the most out of the machine, as many tools should be used simultaneously as the nature of the job will permit. In some cases, where the heads cannot be brought sufficiently close together to permit mounting the tools in the required position, an offset tool-holder can be clamped in the clapper-block, which will support the tool in the desired position. "Reach" type tools are sometimes used, which have a smaller clapper-box attached to the end of the "reach," into which the tool is clamped. Often the work is arranged on the table in two rows, side by side, in order to use all the heads simultaneously.

Flat surfaces are planed with four tools which cut simultaneously. Two tools are mounted in each rail-head, as shown in Fig. 1, and are spaced a distance of one-fourth the width to be planed. These tools are clamped in the clapper-block with their cutting edges at the same height. They are fed down into the work to the required depth together, after which the down feed is stopped and the cross-feed engaged. With the four tools feeding across the work simultaneously, it is only necessary to feed a distance of one-fourth the width of the surface being planed.

In some cases, flat surfaces are planed with tools mounted on a rigid cross-bar which is attached to the two rail-head clapper-blocks as shown in Fig. 2. This is referred to as a "rake tool." Planers with such a tool arrangement are also being used to machine five T-slots simultaneously. The cross-bar is rigidly secured to the clapper-block in the right-hand head, but is mounted in the left-hand head in such a way that it can move endwise a small amount relative to the clapper-block. This type of mounting is necessary to allow for variations in the rate of traverse of the two heads along the cross-rail. Cylinders *B* contain springs which counterbalance the weight moments around the clapper-block pivot pins, so that the tools can be easily lifted on the reverse stroke. The cable *C* supports a counterweight which is suspended from the left-hand housing and which counterbalances the combined weight of the slides, toolboxes, cross-bar, tools, etc. The parts are somewhat over-counterbalanced to take up all backlash of the down-feed screws and nuts.

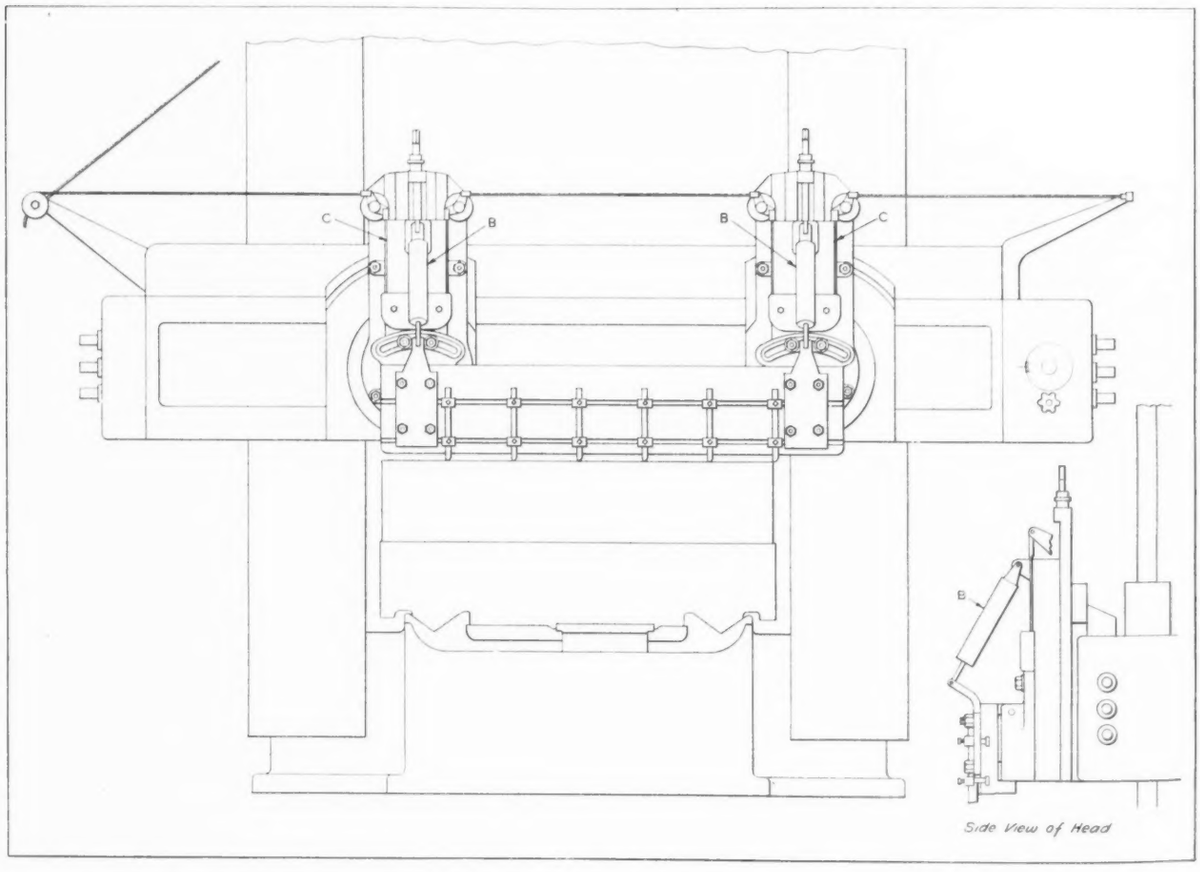


Fig. 2. Rake Type Tool Consisting of a Rigid Cross-bar Attached to the Two Rail-head Clapper-blocks to Provide for Holding Several Planer Tools

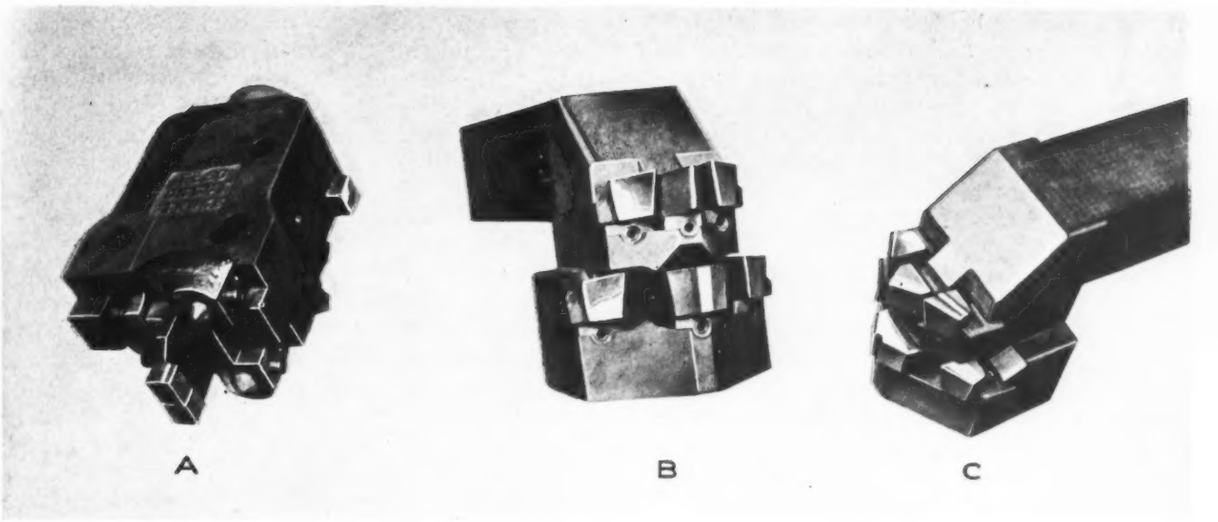


Fig. 3. (A) Special T-slot Cutter Arranged to Cut on Reverse as well as on Forward Strokes. (B and C) Tool-blocks with Multiple Tools for Planing a Number of Surfaces Simultaneously

T-slots are also being planed with special tool-heads, such as shown at *A*, Fig. 3. This tool-head is arranged to cut on the reverse stroke, as well as on the forward stroke. The feed is automatic and occurs at both ends of the stroke. The two-edged cutting tool, which cuts out the tee part of the slot, is clamped to a vertical trunnion shaft. At each reversal of the planer table the trunnion shaft is oscillated a small amount by spring-loaded poppets, which engage the end of the part being planed just before the cutting edge of the tool comes in contact with the work. There are two stop-lugs on the head of the trunnion shaft which alternately engage a stop on the body of the holder. The pressure on the tool holds the trunnion shaft firmly against further rotation once the cut has started. Two tools of this kind are mounted on the planer heads, the tool-holders being clamped in the regular clapper-blocks. A bar across the front of the tool-holder is connected by through-bolts to a bar behind the slide to make the clapper-block firm on the reverse stroke of the table. Operators who formerly lifted the tools out of the slot with a long stick during the return stroke voice their approval of this development. With the new tool-heads, two T-slots are planed in less time than was required for one slot using the old method, and with less effort on the part of the operator.

A number of surfaces in different planes and in angular relation to each other are being planed simultaneously by the use of tool-blocks that resemble a short section of a broach with inserted teeth, as shown at *B* and *C*, Fig. 3. This tool was developed for rough-planing a V-shaped guideway. The combined length of the cutting edge is approximately 12 inches. The tools are fed down into the work a small amount at each pass. This type of planing requires considerable power, and the machine must be very rigid. Special tool-lifters, usually air-operated, are required to lift the heavy tool-blocks during the reverse stroke. Finishing is done in the usual way with a broad tool and a coarse feed.

Gang tools consisting of three or four tools, set in a holder so that each tool takes its proportional share of the total feed, are also used. The total amount of feed for each pass of the work depends on the feed per tool and the number of tools employed.

Setting up Work to Increase Output

Developing improved set-ups probably offers the most fertile field for increasing the output of a planer. It is said that setting up work on a planer is more difficult than on any other type of machine tool, especially when a number of small or medium-size pieces of irregular shape are to be machined at one time. The reason for this is that the work is subjected to the intermittent cutting pressures of the different tools, as well as to inertia forces developed during reversal. Also, when finish cuts are taken, care must be exercised to avoid bending or warping strains due to clamping.

In gang planing, when a number of pieces are planed at one time, the set-up time may be greater than the actual cutting time. The work must be lifted on the table, clamped in place, and after being planed, it must be removed from the table, and the table cleaned off in preparation for the next load. While all of this is being done, the planer is standing idle, so far as cutting metal is concerned.

On planers with divided, or duplex, tables, work can be planed on one half of the table while the other half is being unloaded and reloaded. A quick-acting coupling connects the two halves

of the table, for bringing one half into the position for planing and placing the other half at the end of the bed for setting up the work. Automatic valves in the ends of the tables where they are joined control the flow and pressure of the lubricating oil to the table ways. The tables can also remain permanently connected for use as one long table.

Set-up Plates Facilitate Handling Work

Set-up plates are sometimes used to reduce the actual non-cutting time. Such plates have T-slots and holes for end and side stop-pins, the same as those regularly used in planer tables. The plates have a key at each end which fits into the center T-slot on the planer table for aligning the plate parallel to the table. Lugs are provided on the ends of the plate for bolting it down on the table. An end-stop on the front end of the planer table prevents the plate from sliding under the cutting pressure. Hooks are provided for attaching chain or cable slings for lifting the plate.

While the parts on one set-up plate on the planer are being machined, finished parts are being removed and rough parts set up on another plate, which is placed on trestles near the planer. The time required to remove one plate from the planer and install the other is small, compared to the total set-up time.

Advantages of Set-Up Fixtures

For some types of work, set-up fixtures are used to advantage to reduce the set-up time. If the fixture has been carefully designed, the part can be clamped in place quickly. The strains due to clamping must be considered to avoid springing the work. Usually, the fixture can be so made that the chips will fall clear of the surfaces on which the part registers, thus minimizing the cleaning time.

Sketch Showing Set-Up Useful on Repeat Jobs

Where the quantity of parts being made does not warrant the cost of set-up fixtures, the parts must be held in the usual way with clamps, end and side stops, etc. In many cases, such jobs are not repeated at frequent intervals and the operator may forget the arrangement he used the last time or another operator may get the job. In either case, somebody has to figure it all out again. A newly trained operator may have to do the job, and, not being so skillful as the veteran, he may spend considerable time on the set-up which, even then, may not be so good as it should be.

To save time and faulty work in making such set-ups, a sketch is made in the tool engineer's department, showing the various clamps, screw-jacks, end-stops, etc., in proper relation to the job. The sketch enables the operator to go ahead with the job without first designing the set-up himself. In some cases, photographs of set-ups can be used in place of a sketch.

Work Lay-Out Plates Save Time

In nearly all jobs requiring planing, the planing operation is the first machining operation performed on the piece, and, in subsequent operations, measurements or locations are taken from the planed surfaces.

In such cases, where a set-up fixture is not used and the piece is more or less complex in form, it is necessary that lines representing the approximate locations of the finished surfaces be scribed on the piece. This is done to insure correct relationship between the finished surfaces and cored holes to be bored later, and to get correct wall thicknesses, etc.

The work of laying off the surfaces to be planed on the piece is done on a lay-out plate before the pieces are brought to the planer. In this way, the planer operator requires much less time to set up the pieces, and the man who lays off the pieces becomes more skilled in this work.

Use of Tool-Setting Gages

Tool-setting gages are used for roughing and semi-finishing operations. The gage or templet is secured to the top of the table at the rear end in the correct relation to the work. The tools are then set to the gage by pulling a paper strip between the tool point and the gage or by using a feeler gage. Much time is saved in setting the tools in the cutting position by the use of such gages, and the chance of error in dimensions is eliminated.

The gages are usually made of cast iron, but sometimes have hardened steel inserts at the points where the tool positions are gaged. When set-up fixtures are used, the tool-setting gage points are sometimes incorporated in the fixture.

Some of the methods here described do not reduce the total man-hours required to plane the parts. The man-hours may even be more in some cases, but the output per machine is greatly increased.

* * *

Cast-Meehanite Tool Shanks

For shops equipped to attach tool tips to shanks, Meehanite offers a suitable shank material. Meehanite castings contain no metals that are on the strategic list, do not load grinding wheels as rapidly as steel, have twice the vibration damping capacity of steel, and can be made available in various shapes.

Pilot-Light Indicating Device for Precision Lathe Work

The possibility of error in precision lathe work that is required to be accurate within 0.00005 inch has been minimized by the application of a pilot-light indicating method developed by M. M. Cunningham, foreman at the Schenectady Works of the General Electric Co. This method eliminates the human element inherent in the familiar practice of using a magnifying glass to determine when the tool makes contact with a surface to be cut. In the new method, electrical contact between the tool and the work closes a light circuit, which indicates to the operator exactly when to set the dial indicator at zero, thus establishing a reliable basis for taking a cut that will be accurate within the required 0.00005 inch.

The tool is brought up to the surface to be cut in the regular manner until it is just about to make contact. From this point on, it is brought up very slowly until the pilot light flickers. A slight further movement serves to steady the light, and it is at this point that the indicator is set at zero. A cut of any desired thickness can then be made, the accuracy depending only on the accuracy of the indicator and its reading.

Either an incandescent or a neon indicating lamp can be used for the pilot light. A small transformer is employed to reduce the standard 110-125 volt circuit to 6 volts for the detecting circuit. One line from the transformer is connected to the bed of the lathe, while the other line is connected to the screw-shell of the light socket. The center contact of the light socket is connected to a metal strip, which makes contact with the lathe tool, being set against the tool when it is locked in the toolpost. The tool is insulated from the post by a piece of varnished cambric or light cardboard.

This indicating method can also be used where the work is stationary, as in large milling operations, by insulating the work from the machine and connecting the center contact of the light socket to the work.

* * *

The American Gear Manufacturers Association reports that industrial gear sales for 1942 are 32 per cent above those for 1941.

Superfinishing Cartridge Punches Increases Life

Several tool shops producing punches for drawing small-caliber cartridge cases have found that by superfinishing these punches the pick-up of metal has been practically eliminated, according to the Automotive Council for War Production. These punches are usually slightly tapered; however, the superfinish process is as successful on these slight tapers as on the truly cylindrical parts. Punch life, up to now, has been relatively short, due to build-up during the drawing operation, which increased the amount of pressure required. Broken punches resulted. It has been estimated that the punch life is increased about 50 per cent by superfinishing.

* * *

Apprentice Molding and Patternmaking Contest

The apprentice molding and patternmaking contest of the American Foundrymen's Association, which has been sponsored annually by its Apprentice Training Committee, will be again held in 1943 at the Association War Production Conference in St. Louis, April 28 to 30. Any foundry or pattern-shop manager who wishes to enter an apprentice in the contest should communicate with the secretary, Apprentice Contest, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

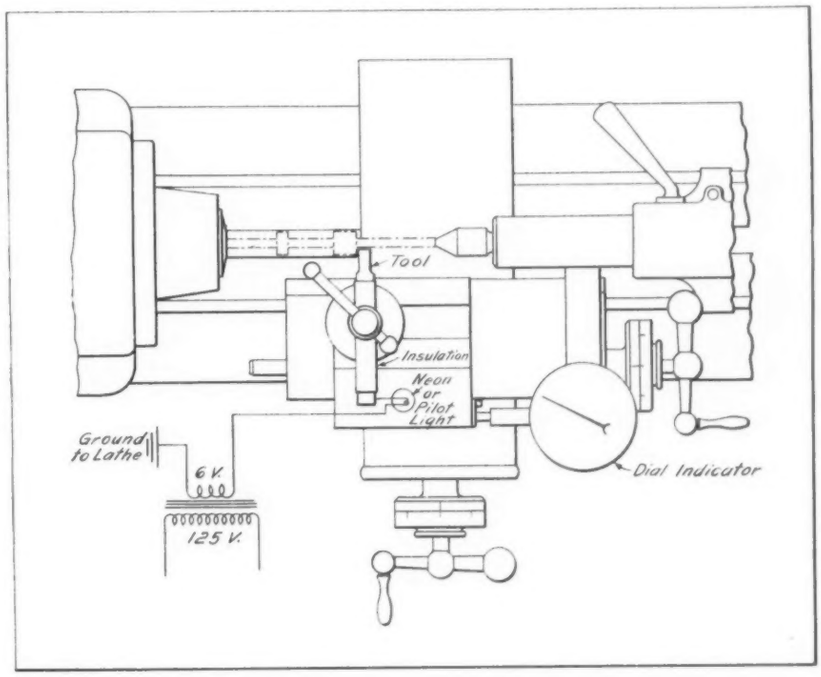
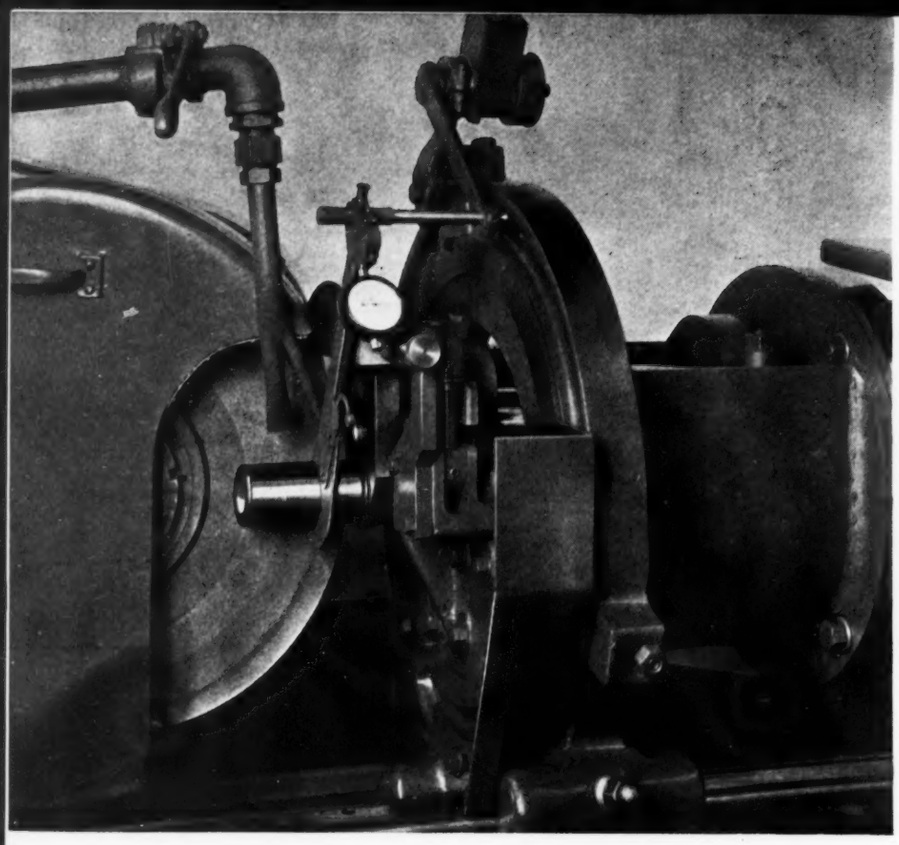


Diagram Showing Method of Applying Pilot-light Indicating Device to Precision Lathe Work



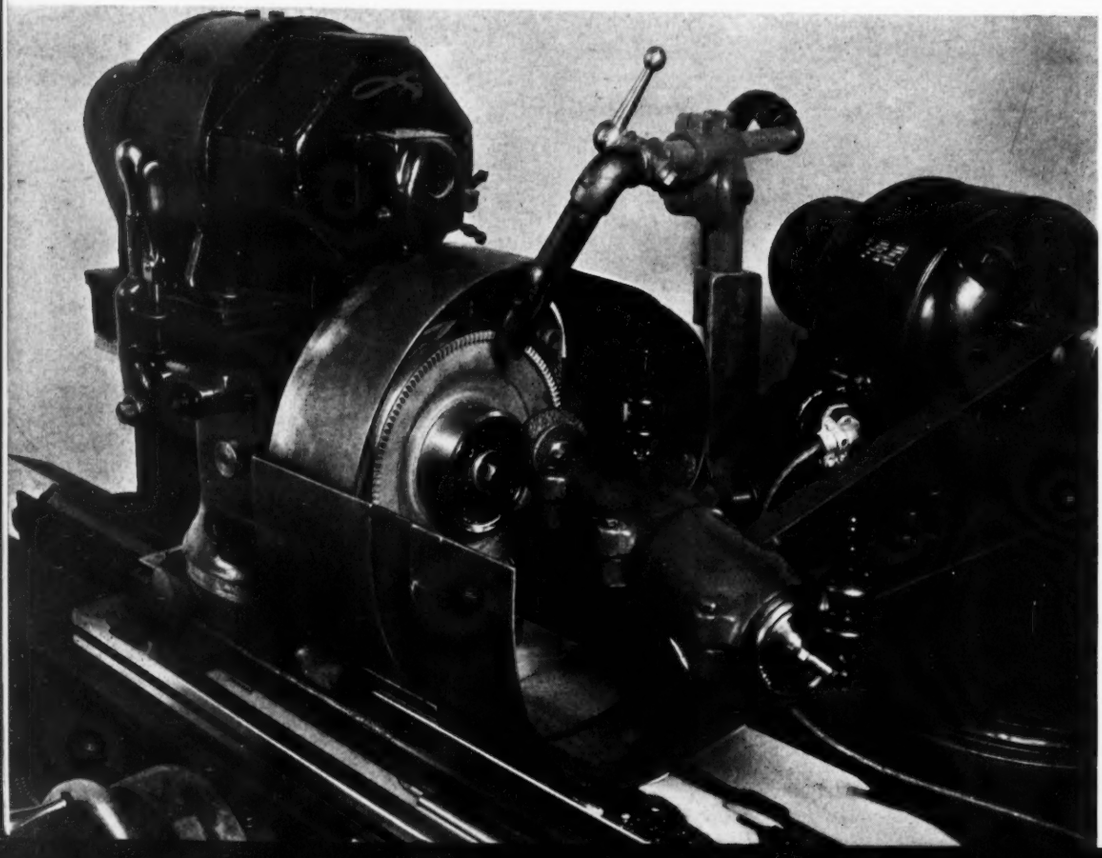
Grinding Methods Aircraft

The Ingenious Arrangements Shown in the Accompanying Illustrations, which were Developed by Norton Company, have

VICTORY

The Grinding Wheel of a Conventional Norton 26-inch Type C Hi-Swing Grinder has been Built into the Machine at 70 Degrees from its Normal Position. Trued with a Special Forming Device, the Side of the Wheel Grinds Two Diameters on the Crankpin of a Double-throw Aviation-engine Crank, while the Wheel Face Proper Grinds a Cheek at the End of the Pin. The Unusual Arrangement of the Wheel Allows the Overhang of the Crank Counterbalance, Shown in Back of the Dial Indicator, to Clear the Wheel

Method Designed to Solve a Russian Aviation Problem. Using a Cup-shaped Wheel, the Entire Hub of a Radial Aviation-engine Cam can be Ground in a Norton 16- by 36-inch Type C Multi-purpose (Universal) Grinder, Using the Internal Grinding Unit Shown. An Overhanging Shoulder and Lateral Teeth Prevent Grinding the Entire Cam Hub in the Conventional Cylindrical Grinder



VICTORY

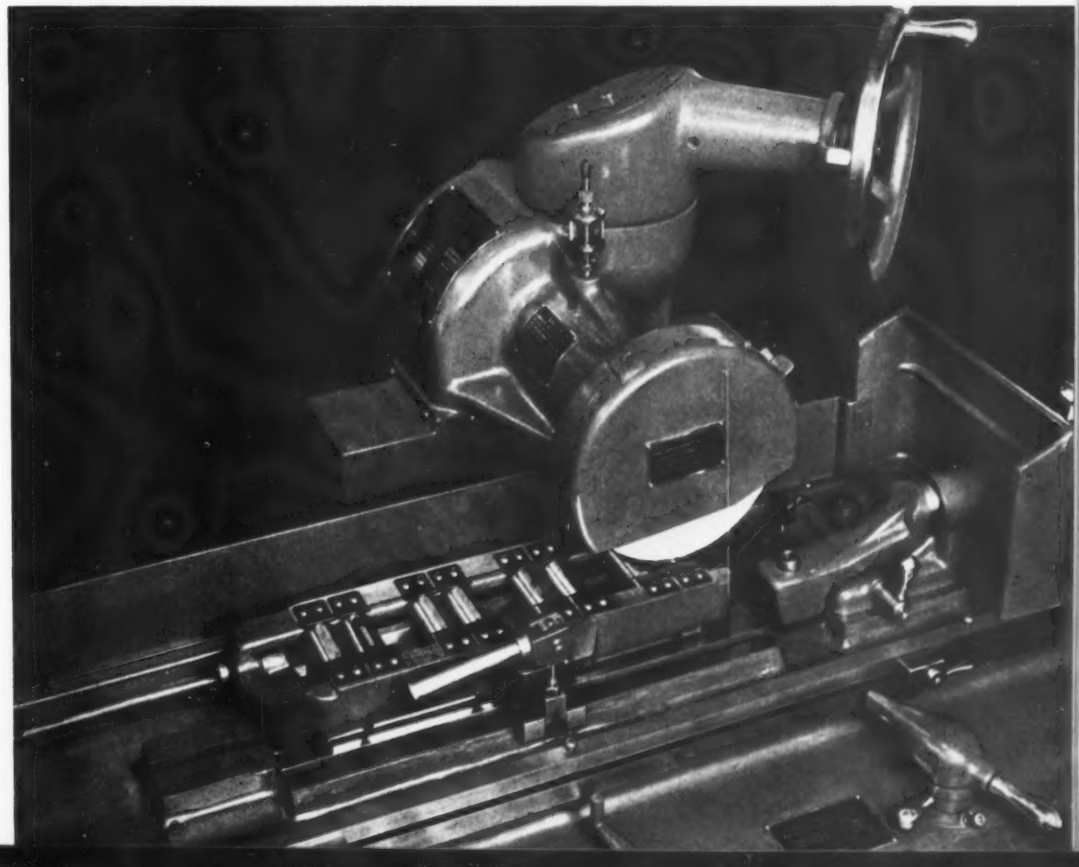
that Aid in Production

Solved Many of the Problems in Aircraft Parts Manufacture Arising in Russian, English and American War Industries

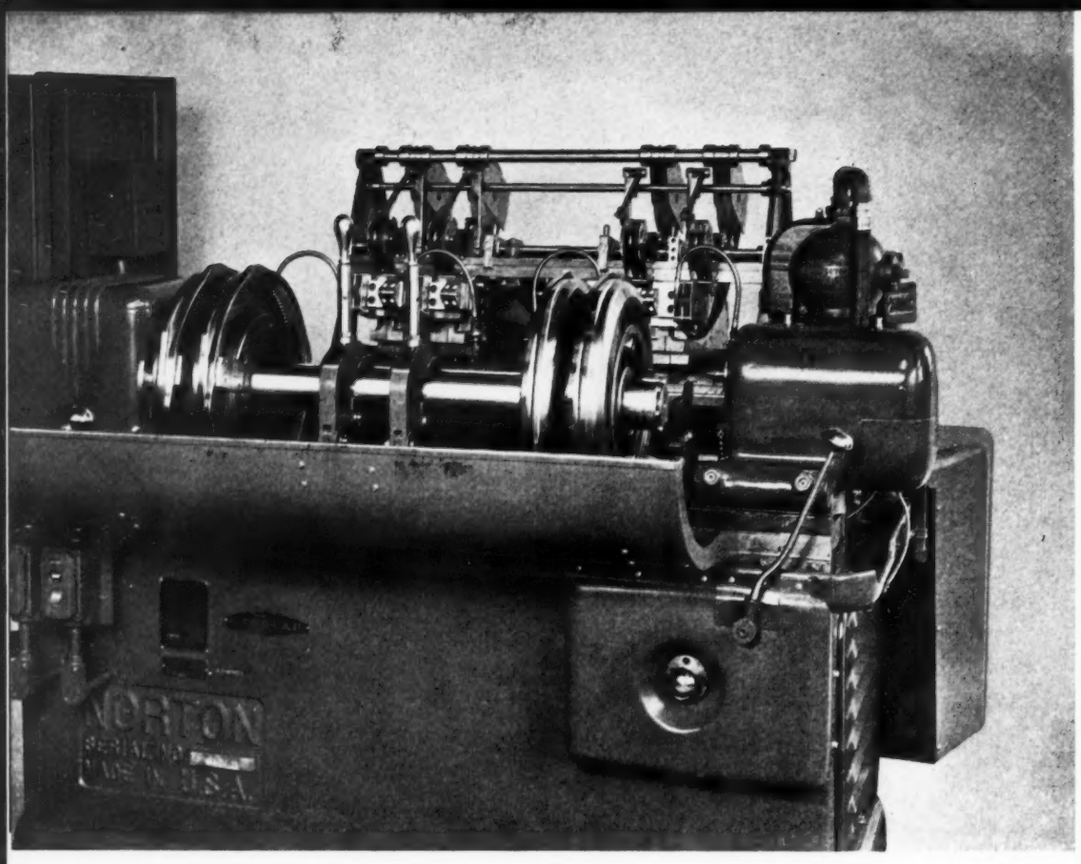
Grinding the Flange Face and Skirt Diameter of an Assembled Aviation-engine Cylinder Barrel and Head, This 10- by 36-inch Norton Type C Grinder with 45-degree Wheel-slide also Produces Simultaneously a 1/16-inch Fillet at the Junction of These Two Surfaces. A Special Expanding Arbor, which is an Integral Part of the Live Spindle Head, Locates the Flange Face Exactly from the Dome Inside the Head. This Insures Accurate Position of the Combustion Chamber in Relation to the Piston when Assembled

VICTORY

Solving an English Aviation Problem. This Standard Norton 6- by 18-inch Surface Grinder, with Hydraulic Table Traverse, is Equipped with a Special Holding Fixture, which, by a Quick-clamping Arrangement, Instantly and Uniformly Secures Eight Articulated Rod Pins. An Oil Flat 0.008 Inch Deep, with Filleted Ends, is Ground in Each Pin at a Good Production Rate

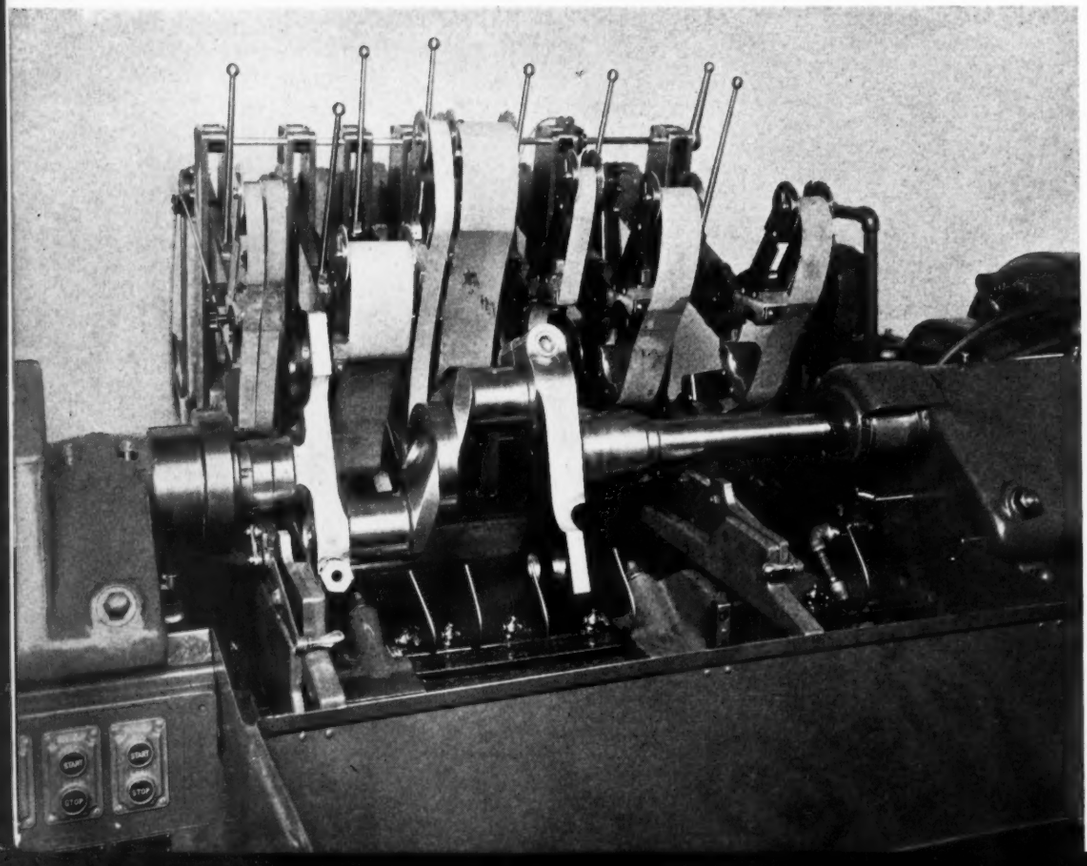


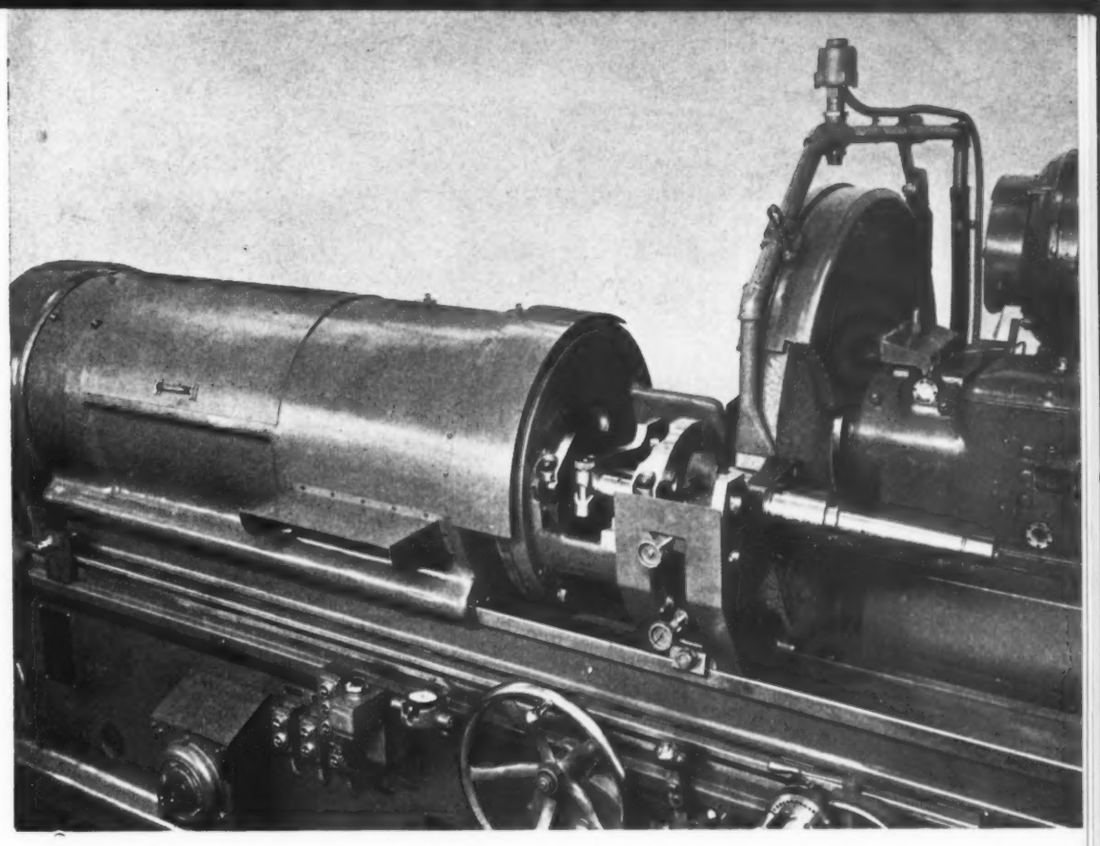
VICTORY



Two Double-face Cams for Radial Aviation Engines are being Lapped Simultaneously in a Norton Special Aircraft Cam-O-Lap. The Cam Contours are Followed by Abrasive Paper Held on Reels, under Impulse of Master Cams on the Work-arbor

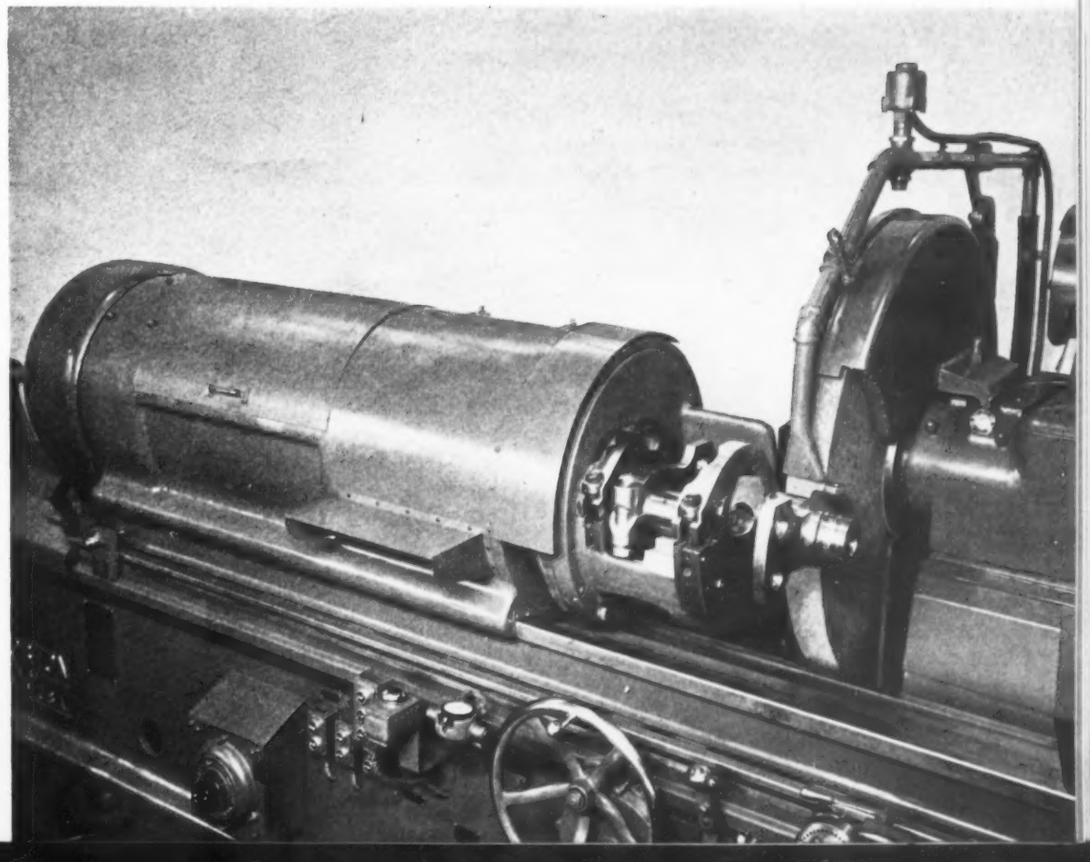
Eight Diameters on a Double-throw Aviation-engine Crankshaft are Lapped Simultaneously in This Norton No. 40 Crank-O-Lap, Shown in Loading Position with Lapping Arms Raised. Abrasive Papers of Varying Widths to Suit the Work being Finished are Fed Automatically with Each Lapping Cycle. The Entire Work Cycle is Automatic





Although This Aircraft-engine Crankshaft has a Protruding Hub, One of the Two Crankpins is Readily Ground by the Use of an Extra Heavy-duty Live Spindle Work-head which is Raised to Swing 26 Inches

In Order to Avoid Objectionable Overhang when Finishing the Second Crankpin of the Aircraft-engine Crankshaft Seen in the Illustration above, it was Found Necessary to Design a Special Work-head which would Allow the Long Protruding Hub to be Inserted in the Hollow Spindle during the Grinding Operation, as Shown below



Engineering News Flashes

New Electron Microscope Measures to One-Millionth Inch

Particles as small as one-millionth of an inch can be measured accurately with a new electron microscope developed by the General Electric Co. With this microscope, small smoke particles only one-millionth of an inch across can be clearly seen and measured. In the new instrument, a specimen can be enlarged 10,000 times. Further enlargement of the picture can be made photographically up to 100,000 times.

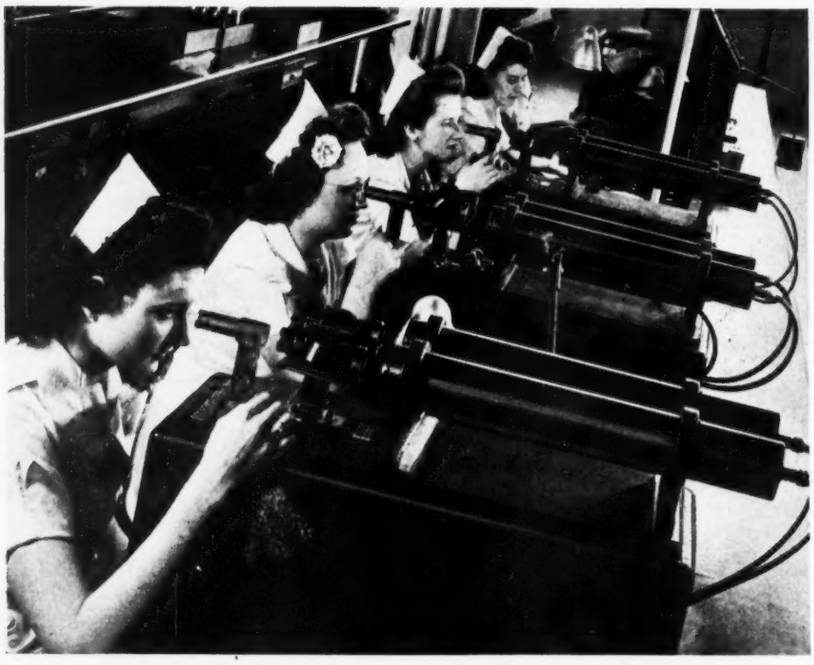
Electric Watchman Protects Generators

A Westinghouse research engineer, Harry C. Werner, has developed an automatic electric watchman the size of a large box camera, which jots down a warning in red ink when it detects vibrations that might eventually cripple a power-producing machine. The instrument — a midget-sized generator of electricity—measures in thousandths of an inch the slightest tremors in the shafts of turbo-generators. By discovering quivers in shafts turning at 3600 R.P.M. and recording a warning, the detector provides a perpetual check on giant power-house machines producing electricity day and night for the nation's war plants and homes.

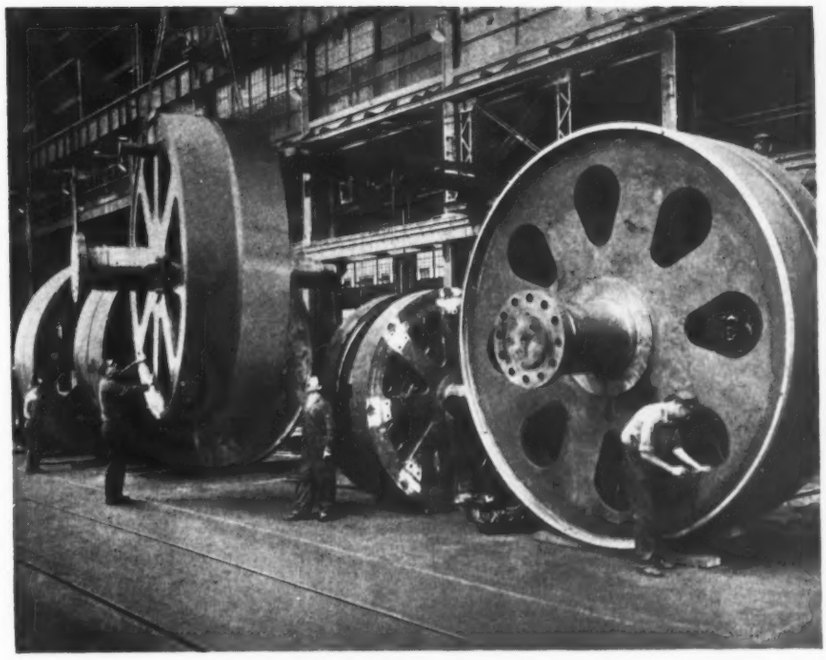
Like a business chart, the vibration record shows month after month how a steel shaft is performing. The recording line normally stays at a steady level, registering normal balance; but in rare instances, the line deviates from its steady course, warning that excessive vibration has developed. Such a deviation tells a power-plant operator that an adjustment is needed to eliminate the unbalance and vibration, thus avoiding a possible breakdown.

Electrodeposition of Hard Nickel with Ammonium Salts

In a paper entitled, "The Electrodeposition of Hard Nickel," presented before a meeting of the Electrochemical Society in Detroit, Mich., by Drs. W. A. Wesley and E. J. Roehl of the Development and Research Division of the International Nickel Co., Inc., it was pointed out that nickel deposits of a hardness of 380 to 480 Vickers can be produced in thickness and quality suited to industrial and engineering applications by the use of electrolytes containing ammonium salts. The soundness and structure of such deposits are markedly influenced by the composition of the plating bath in respect to other ingredients. Important improvement in the quality of the product can be accomplished by replacing the old hard baths with one com-



Girl Inspectors in the Binocular Assembly Room of the Westinghouse Electric & Mfg. Co. Resemble Machine Gunners Sighting a Target as They Peer into Binoculars Mounted in Front of Long Tubes Known as "Collimators." The Latter Permit a Thorough Check of Each Binocular for Sharpness and Definition of Image and Also Test Alignments. The Work is Done in a Room Completely Protected from Dust by "Precipitrons," a Type of Electric Air Cleaners. The Girls Work in Starched Uniforms and Must Use No Facial Make-up, because Even a Flake of Powder on the Sensitive Lens would be Detrimental



These Huge Bull Gears which Transmit Power from Ship Steam Turbines to the Propellers are just Coming off the "Production Line" of an Eastern Plant of the Westinghouse Electric & Mfg. Co. Some of These Gears are 13 Feet in Diameter; yet They are Cut in Air-conditioned Rooms to the Greatest Accuracy Known in Gear Manufacture

posed of nickel sulphate, ammonium chloride, and boric acid. The hardness of deposits made with this bath varies but little with change in thickness, and can be easily maintained by control of the plating conditions.

Glass-Fiber Insulation Increases Brass Furnace Output

Owing to the wartime demand for mica, the Western Cartridge Co. is now using Fiberglas tape in place of mica as coil insulation in the primary coil of induction type brass furnaces. Use of the Fiberglas-tape insulation has made it practicable to increase furnace temperatures to the point where it is possible to produce five pours of 1500 pounds each during each eight-hour shift, whereas with the mica insulation the limit was three pours of 1500 pounds each in an eight-hour shift—an increased production of 3000 pounds per shift per furnace.

The cost of the glass-fiber insulation is 50 per cent less than the mica. The number of man-hours required to install the Fiberglas insulation is less than half that required for the installation of mica. Approximately one thousand induction type furnaces are used by the large brass companies.

Gas-Turbine Locomotive Built in Switzerland

The first gas-turbine locomotive ever built was described at the recent annual meeting of the American Society of Mechanical Engineers by Paul R. Sidler, resident engineer in New York of Brown, Boveri & Co., Ltd., of Switzerland. The outbreak of the war delayed the completion of this novel locomotive, built for the Swiss Federal Railways; but in spite of many difficulties, it was finished in the fall of 1941. Several road tests were made which demonstrated that the locomotive not only met the prescribed requirements, but in many instances exceeded expectations. Mr. Sidler said that it must be understood that the gas-turbine locomotive is not yet a serious competitor of the Diesel locomotive, although in certain classes of service it shows marked advantages. It is expected to be suitable especially for express service over long distances in areas where water is scarce and where there is a considerable difference in the cost of Diesel oil and ordinary fuel oil.

Rubberflex Bushings for Combat Equipment

A new line of rubber-insulated bushings capable of absorbing vibration and shock are made by Bushings, Inc., Berkely, Mich. These bushings are said to save from 60 to 80 per cent of the rubber in one important application alone, and at least from 10 to 20 per cent of the amount usually required for bushings of this type of the conventional design, without reduction in efficiency or life. These bushings are made in a wide range of sizes exclusively for armed combat equipment. Known as "Rubberflex," they have a thin layer of live rubber between two bushings of metal to which the rubber is held entirely by the friction and elasticity of the rubber itself.

Using Available Machine Tool

Under Present Conditions Every Machine Shop Cannot Have New Machine Tools, but the Tools, Tooling Equipment, and Their Application can be so Improved that Satisfactory Results May be Obtained from Machines Now on Hand

By W. K. BAILEY
Vice-President
Warner & Swasey Co.
Cleveland, Ohio

Fig. 1. One Man Should be Given the Responsibility for Grinding All Carbide Cutters Used in a Department

THE production of turret lathes has been expanded to several times the normal rate. Every one of these machines is used in the war effort. However, such is the demand, particularly from concerns that have now converted their facilities from peacetime production to war work, either as prime contractors or as sub-contractors, that the need for new machine tool equipment far outstrips the ability of the industry to supply it.

Fortunately, from long experience in helping machine tool users to get the maximum out of their turret lathes and other machine tools, our company's field engineers have found that many operating problems and production difficulties can be solved, after a fashion, at least, with the equipment at hand. Therefore, while the war requirements have made it impossible to supply new machine tool equipment to meet every demand, our company is trying to do the next best thing—to supply companies, upon request, with the services of one of these trained men, familiar with making the most of the machining equipment available in the plant. In some cases, by helping to rearrange work and equipment, these men have made it possible to reach the necessary production goals without new machines. In such instances, this has not only speeded up production now—when it is most desperately needed—but has released new machines for shipment to other plants where no alternative measures would suffice.

Conditions that Generally Require Attention

In general, the difficulties met with are found to fall broadly into eight classes: (1) Tool problems, such as improper choice, care, grinding, or setting; (2) fixtures out of balance, not rigid enough, etc.; (3) inadequate or incorrect speeds and feeds; (4) unsatisfactory handling of operations on machine; (5) using the wrong size of machine for the job; (6) inadequate supervision of men making tool set-ups; (7) poor scheduling of work through machining departments; and (8) confusion and lost time at change of shifts.

At an aviation parts plant, for example, it was found that few carbide tools were being used, because of the excessive amount of breakage experienced with them. Upon investigating this situation, it was brought out that no one had undertaken to teach the men the proper methods of brazing and grinding carbide-tipped cutters, nor had anyone taught them the basic principles of determining and developing the

Equipment to Best Advantage

proper clearance angles. The situation was speedily remedied by teaching the men to make up some cutters themselves with their own equipment. A chip-breaker grinder was the only piece of equipment they did not have for all-around cutter grinding, and this was obtained without delay.

After a number of the carbide-tipped cutters had been made, they were put in operation on several so-called "impossible" jobs, and demonstrated successfully. At the field engineer's suggestion, one man was appointed to head up the application of carbide cutters for work on turret lathes, engine lathes, boring mills, and milling machines. That plant will have no further trouble—and on the jobs on the turret lathes alone, where the carbide tools were applied, a saving in machining time of between 50 and 80 per cent was immediately obtained!

Fig. 2. Two or More Cuts can Frequently be Taken Simultaneously on the Turret Lathe to Advantage

In another plant, the use of carbide cutters was limited, due to the fact that every operator kept two or three cutters in his tool box, only returning them to the tool crib for regrinding when he got around to it. It was recommended that the system of having operators check carbide tools in and out be abolished. In place of this, it was suggested that the foreman of the department be charged with the cutters and one of the workers be designated by him to go to the tool crib and pick up reground cutters as needed.

A company whose shop experience had consisted essentially of punch press and header work had never had any experience with carbide cutters. Very little turning work had been done in the tool-room. Under the circumstances, when some war work was undertaken, a number of new machining problems were immediately encountered. Among other things, this shop did not have any means of caring for carbide cutters, especially when they were not in use. These cutters were piled up on benches, along with a great many other tools, and it was not surprising that the edges were frequently chipped off. It was promptly recommended that trays be built to hold each tool separately, eliminating any danger of the cutters being damaged.

In another case, carbide tools were being used without an adequate supply of coolant. Much trouble resulted, and the operator was unable to find the cause. The field engineer, after studying the problem, emphasized the first rule for using coolants on carbide cutters—a generous quantity, or none at all.

Setting Tools in Correct Position

The difficulty in another instance was due to the practice of setting the carbide cutters by eye, without realizing the importance of having the cutting edge slightly above center in most cases, as shown at the right in Fig. 3. This was explained to the tool-maker, and then the field engineer had a setting gage for the square turret made very accurately, so that the operator could be sure of always having the cutting edge of the tool slightly above center.

On cutters used in a heavy-duty multiple turning head, the problem was a little more difficult. To set the cutting edge in the same relation to the center (namely, slightly above center), a line was inscribed (Fig. 4) from the center of the hole holding the angle cutter holder to the

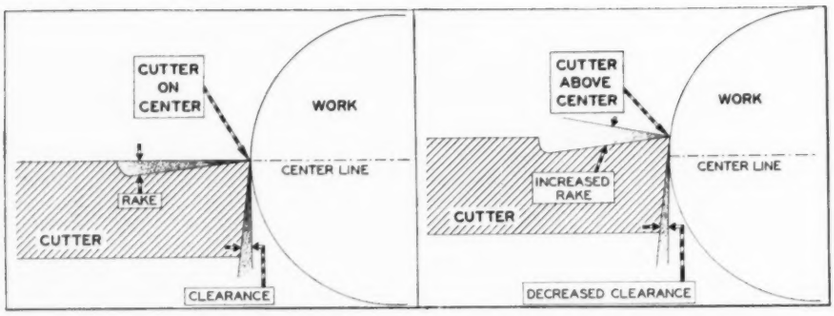


Fig. 3. Presenting Carbide Tool to the Work (Left) on the Center Line, a Method not Recommended, and (Right) Above the Center Line of the Work, which is the Recommended Warner & Swasey Method

center hole of the multiple turning head. The latter hole is concentric with the spindle. A square was then used to set the cutting edge slightly in advance of the center.

Sometimes difficulties are met with which could not have been foreseen. A case in point was traced to the type of material being cut. Here the chips broke up in small particles and caused trouble by lodging in the grooves of the overhead pilot bar. The sleeve of the pilot bar did not push the chips out of the grooves, and the result was badly scored bushings. To overcome this, the field engineer reversed the overhead pilot bar, and scoring was eliminated.

In our experience, one man should be made solely responsible for the grinding of all carbide cutters, and a standard method of grinding should be strictly adhered to after performance tests establish the type of grinding to be used. Carbide cutters are not a "cure-all," and each installation requires a thorough analysis to determine the proper grade of carbide for the material being cut, as well as the proper clearance angles on each cutter for the job on which it is to be used. If this practice is followed, carbide cutters can be used most successfully.

Use Right Size of Machine for Work in Hand

Production in many cases has been found to be retarded because operations were being performed on turret lathes larger than the jobs actually required. In general, such machines do not have high enough speeds for unusually small work. The larger size and bulk of the machines results in slower manual handling. Company policy, influenced by anticipation of heavier work to come, has sometimes resulted in the purchase of machine tools of larger size than needed for the work being done. In addition, some of the trouble is caused by orders and raw material coming into a plant without sufficient time allowance to permit scheduling work to the proper-sized machines. As a result, to get the work out by the date requested on the shop order, it has to be put on the first available machine, regardless of its size.

In a plant making a variety of parts in comparatively small quantities, and generally in a rush, the work had to be done on ram type turret lathes. Many of the parts were quite small in size, so that the standard spindle speeds of the machines available were entirely too slow. To help improve the production on this type of work, the field engineer suggested that two-speed (standard and double standard) motors be provided for each ram type turret lathe—and the problem was solved without purchasing new machines.

Using the Cutting Tools to Best Advantage

Many of the cuts being taken on turret lathes and other machine tools with high-speed steel cutters are frequently found to be at too slow a rate. In such cases, it is suggested that the feeds and speeds be increased wherever possible, to more nearly the ultimate that the job being handled and the cutters can stand.

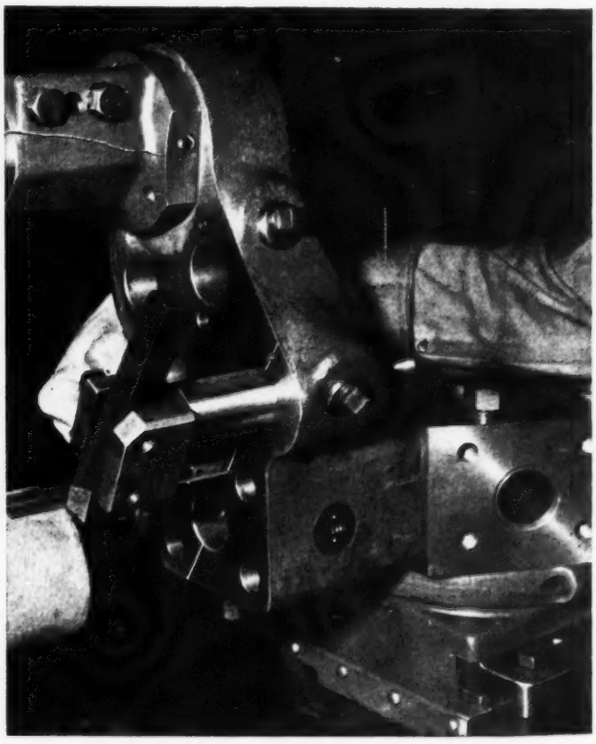


Fig. 4. Scribing a Line on a Heavy-duty Multiple Turning Head to Aid in Setting Cutting Edge of Tool

In one plant, a number of special cutter-holders (boring-bars, etc.) in use were found to be too weak in construction. Some special fixtures, again, were too massive for the jobs to which they had been assigned. Designed without regard for dynamic and static balance, they likewise limited the use of the proper feeds and speeds.

It was also observed that some of the turret lathes in this plant were being used in "engine lathe" fashion—that is, for a single cut at a time. Attention was called to the possibility of saving time by taking two or more cuts simultaneously (Fig. 2), either from the same tool position (multiple cuts), or one from the hexagon turret unit and another from the cross-carriage unit working at the same time (combined cuts). The saving in production time was shown on several jobs to be substantial.

In another case it was found that a fairly large percentage of turret lathes were standing idle. This condition was not due to the fact that operators were not available for the machines, but rather that operators were either waiting for cutters to be ground or were in the tool crib checking out carbide cutters. It was also observed that, in many cases, the individual operator would decide upon the feeds and speeds of a particular job, and that in no case were groups of machines, operating on practically identical jobs, being run at similar feeds and speeds. This situation was quickly remedied by the installation of a production control system, the individual machine tools being operated on a time-study basis. There were also complaints in this plant about the authority assigned to the individual supervisors. If the work were routed to the individual machine with a standard set-up, this problem could also be quickly remedied.

Another problem concerned the time lost during change of shifts. The various "lead" men over the individual groups of machines finished their day's work at the same time that the second-shift "lead" men reported to work. As a result, there was considerable confusion in changing shifts. A staggered or overlapping system of working hours for the supervisors is expected to go far toward remedying this problem.

Another company, in peacetime the manufacturer of frames, pipe, and cracking stills, was asked to tool up for the production of aircraft struts, torpedo tubes, and bombs. A number of new machining problems were immediately encountered. For example, there was the

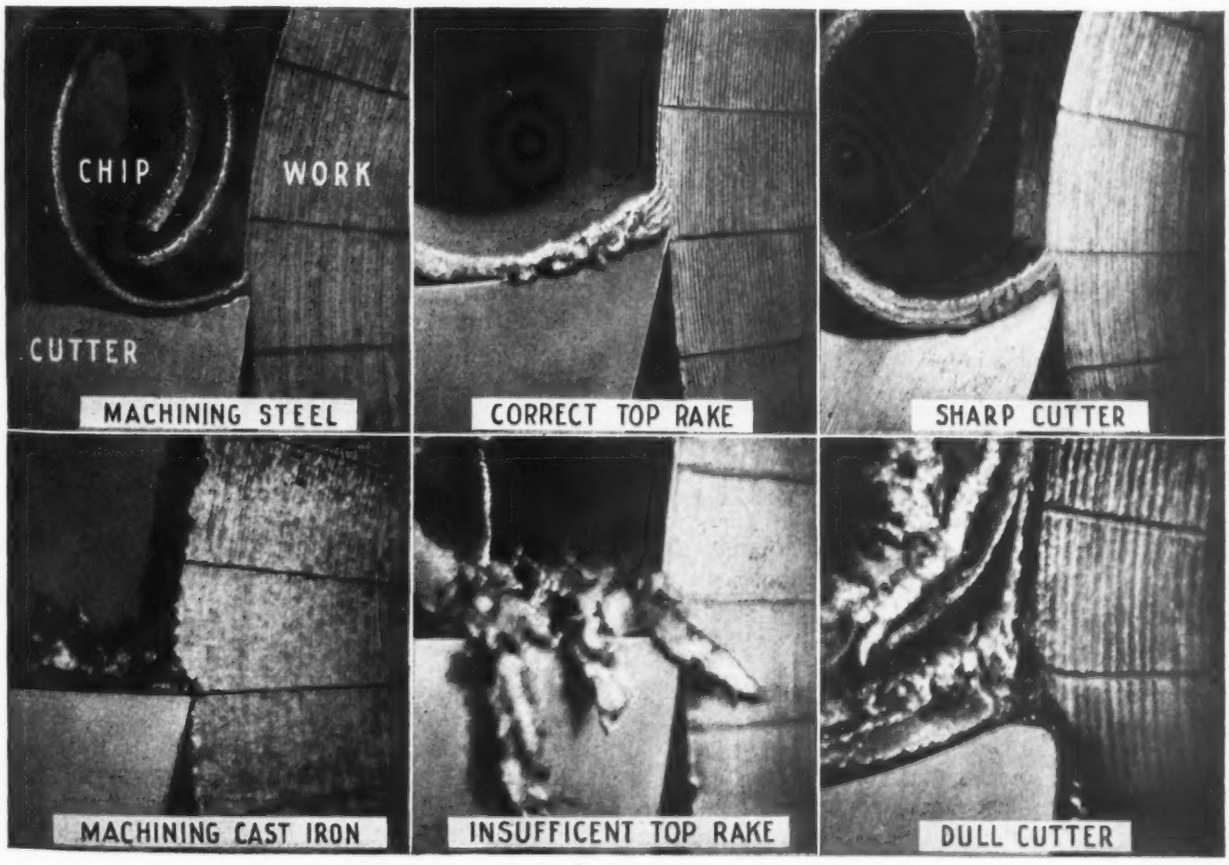


Fig. 5. Illustrations Showing Action in Cutting Steel and Cast Iron, Correct Way of Grinding Tools, and Comparison between the Cutting Action of a Sharp and a Dull Cutter

problem of turning blanks for cluster gears. There was no machine available to do this work, which should properly be done on a turret lathe or automatic bar machine. It was found, however, that a power hacksaw was available, as well as a drill press and several unused milling machines and engine lathes. The sequence of operations, as worked out by the field engineer, was as follows: (1) Cut blank from bar stock with power hacksaw; (2) drill and ream center hole on drill press; (3) rough-turn on milling machine, with blank mounted on arbor and form cutter clamped on milling machine table; and (4) finish-turn on engine lathe. The results of this operation, while less efficient, were the same as though the blank had been finished on one machine, which was unavailable, instead of on four machines that were idle.

Obviously, the majority of the war production work demands high-production machinery, but when this equipment is not available, the problem is solved by using engine lathes, drill presses, or turret lathes. While more time is thus consumed, these machines do the job required to be done; and with war production at stake, that is the most important consideration.

One shop which manufactures equipment for landing fields reported serious difficulty in obtaining the output our company said could be reached after the job was completely tooled. Our engineers, sent to investigate the trouble, found the machine and its tools quite in order, but investigation revealed sudden drops in air pressure used for actuating the chuck. This was cured by tracing the cause to air valves on a battery of punch presses in another part of the shop.

Some Examples of Simple Remedies for Serious Difficulties

In another case, the field engineers were called in to suggest a method of obtaining satisfactory production on a sub-contract order. They found that 180 pieces of alloy-steel tubing had been scrapped, which represented the entire production so far, because of poor threads. They advised the purchase of a thread-chasing attachment for the carriage apron of the old style turret lathe, because no such attachment was available for the saddle apron. The saddle was linked to the cross-slide, and the chasing attachment was used on the cross-slide to lead the die-head on the hexagonal turret onto the work. Satisfactory threads have been produced ever since.

Again, on another sub-contract, there was a great deal of lost time because of unsatisfactory finish, two operations being used when one should have been sufficient. The entire situation was cleared up with the recommendation and purchase of one single-cutter turner.

In a recent expansion of a small aircraft company, one heavy-duty drilling machine was recommended to be bought for a particular operation, thereby saving the purchase of four large turret lathes. In another department of the same concern, the field engineer's suggestion of replacing four heavy universal turret lathes with a thread miller was followed successfully. In a contemplated expansion program, the engineer even advised the purchase of a competitor's equipment on one operation to release four turret lathes that could be more advantageously used on other parts. Because the country is faced with a serious situation in supplying tools and machines, our men have been instructed not to hesitate to recommend other makes of equipment, so long as they are known to be satisfactory.

The paramount consideration today, as we see it, is to do everything we can to help win the war. Nothing short of that on the part of all of us will bring victory.

* * *

Visual "Learning Guides"

The United States Office of Education has produced a number of films for use in shop training. These films, through their simplicity and clarity, contribute greatly toward the training of inexperienced war workers. However, the instruction given by the films needs some reinforcement to be retained by the memory. The National Audio-Visual Council, Inc., 160 N. LaSalle St., Chicago, Ill., has, therefore, brought out a number of sheets known as "Visual Learning Guides." These provide supplementary instruction, tied directly to the subject of the films. These guides or charts give the student brief information on the subject before the film is shown, telling him in advance to what important sections he must especially pay attention. Then a number of questions are provided through which the student may discover what he has learned and what he has missed. It also provides him with a permanent reference source for reviewing the subject.

* * *

Punch Press Adaptation on Gun Tube Job

One method of speeding up production in assembling a 3/8-inch brass ring on the breech end of a gun barrel is recorded by the Automotive Council for War Production. This ring was formerly peened into the groove by hand hammering. It took thirty minutes to complete the operation. By setting up a holding fixture and using a press, the time on this operation was cut to three minutes.

MACHINERY'S DATA SHEETS 483 and 484

RECOMMENDED TOOL ANGLES, FEEDS, SPEEDS, ETC., FOR MACHINING WITH CEMENTED-CARBIDE TOOLS—5

Material	Brinell Hardness	Clearance, Degrees: Front Tool Angle	Clearance, Degrees: Side Tool Angle	Top Rake, Degrees	Depth of Cut, Inch: Roughing	Depth of Cut, Inch: Finishing	Feed, Inches per Rev.	Speed, Surface Feet per Min.: Roughing	Speed, Surface Feet per Min.: Finishing	Remarks
Steel, S A E 3450..	444	2	2	—4	1/8	....	0.028	365	....	
Steel, S A E 3450..	375	4	4	0	1/8	....	0.032	375	....	
Steel, S A E 3450..	302	6	6	4	3/16	....	0.028	350	....	
Steel, S A E 4140..	429	2	2	—4	....	0.018	0.012	....	775	Fine boring. Glass finish.
Steel, S A E 4140..	388	2	2	—4	3/16	0.028	0.021	430	800	Intermittent.
Steel, S A E 4140..	341	4	4	—2	1/8	....	0.026	....	340–420	
Steel, S A E 4150..	461	2	2	—4	1/8	....	0.022	300–410	....	Eight hours between grinds.
Steel, S A E 4150..	401	2	2	—2	3/16	1/32	0.024	350	470	
Steel, S A E 4150..	341	4	6	0	5/16	....	0.028	350	....	
Steel, Silicon	...	4	5	—3	0.080	....	0.026	900	....	Intermittent cut.
Steel, Silicon	...	6	4	—4	....	0.080	0.022	....	975	Intermittent cut.
Steel, Stainless ...	235	4	4	—3	....	0.020	0.018	300–350	....	
Steel, Stainless (Cast)	220	4	4	—4	1/8	....	0.022	250–300	....	
Steel, Stainless (Cast)	220	4	4	—4	1/4	....	0.022	200–300	....	
Steel, Tool (Die)..	550	2	2	—4	1/8–1/4	0.012	0.022	180–220	250	
Steel, Tool	627	4	4	—4	1/16	1/32	0.018	250–350	300–350	Hardened.
Steel, Tool	682	4	4	—4	1/16	0.018	0.020	150–200	200–250	(63 Rockwell C.)
Stellite (J-Metal) .	...	2	2	—6	....	0.025	0.016	135	....	Turning.
Stellite, Welded-on.	...	4	4	—3	0.090	0.016	0.018	155	155	Boring.
Stellite, Welded-on.	...	4	4	—3	0.125	....	0.020	250	....	Turning.

MACHINERY'S Data Sheet No. 483, February, 1943

Compiled by C. G. Williams, Chief Engineer
Luria Steel & Trading Corporation, New York

AERONAUTICAL SCREW THREAD SERIES

Size	Basic Major Diameter, Inches	Thread Series (A.N. Form): NC	NF	NEF	8N	12N
		Number of Threads per Inch				
0	0.0600	..	80	The thread series listed in this table are from the National Bureau of Standards Handbook H28, "Screw-Thread Standards for Federal Services." These are recommended selections from standard thread series.		
1	0.0730	64	72			
2	0.0860	56	64			
3	0.0990	48	56			
4	0.1120	40	48			
5	0.1250	40	44			
6	0.1380	32	40			
8	0.1640	32	36			
10	0.1900	24	32	..	..	..
1/4	0.2500	20	28	32	..	..
5/16	0.3125	18	24	32	..	..
3/8	0.3750	16	24	32	..	..
7/16	0.4375	14	20	28	..	..
1/2	0.5000	13	20	28	..	..
9/16	0.5625	12	18	24	..	..
5/8	0.6250	11	18	24	..	..
11/16	0.6875	..	..	24	..	..
3/4	0.7500	10	16	20	..	..
13/16	0.8125	..	..	20	..	..
7/8	0.8750	9	14	20	..	..
15/16	0.9375	..	..	20	..	..
1	1.0000	8	14	20	..	..
1 1/16	1.0625	..	..	18	..	12
1 1/8	1.1250	..	..	18	8	12
1 3/16	1.1875	..	..	18	..	12
1 1/4	1.2500	..	..	18	8	12
1 5/16	1.3125	..	..	18	..	12
1 3/8	1.3750	..	..	18	8	12
1 7/16	1.4375	..	..	18	..	12

Size	Basic Major Diameter, Inches	Thread Series (A.N. Form): NEF	8N	12N	16N
		Number of Threads per Inch			
1 1/2	1.5000	18	8	12	..
1 9/16	1.5625	18	..	..	..
1 5/8	1.6250	18	8	12	..
1 11/16	1.6875	18	..	..	..
1 3/4	1.7500	16	8	12	16
1 13/16	1.8125	..	..	..	16
1 7/8	1.8750	..	8	12	16
1 15/16	1.9375	..	..	..	16
2	2.0000	16	8	12	16
2 1/16	2.0625	..	..	..	16
2 1/8	2.1250	..	8	12	16
2 3/16	2.1875	..	..	..	16
2 1/4	2.2500	..	8	12	16
2 5/16	2.3125	..	..	..	16
2 3/8	2.3750	..	..	12	16
2 7/16	2.4375	..	..	..	16
2 1/2	2.5000	..	8	12	16
2 5/8	2.6250	..	..	12	16
2 3/4	2.7500	..	8	12	16
2 7/8	2.8750	..	..	12	16
3	3.0000	..	8	12	16
3 1/8	3.1250	..	..	12	16
3 1/4	3.2500	..	8	12	16
3 3/8	3.3750	..	..	12	16
3 1/2	3.5000	..	8	12	16
3 5/8	3.6250	..	..	12	16
3 3/4	3.7500	..	8	12	16
3 7/8	3.8750	..	..	12	16
4	4.0000	..	8	12	16

MACHINERY'S Data Sheet No. 484, February, 1943

Compiled by National Bureau of Standards,
U. S. Department of Commerce

Silver Replaces Scarce Metals in Soft Solders

The use of silver is saving huge quantities of tin in plants of the General Electric Co. In 1940, the company used approximately one million pounds of tin. Last year, in spite of the fact that production had more than doubled, it is estimated that the amount of tin consumed was the same. Thus, savings of more than 50 per cent in the company's normal requirements of tin are being effected. This is due in no small measure, to the use of increased silver content in tin alloys.

One of the most extensive substitutions of silver is for tin in soft solder and for copper in brazing alloys, used for connecting conductors—bars or wires—in virtually every type of electrical equipment manufactured by the company.

Soft solders—alloys that require comparatively low temperatures in joining metals—have had a relatively high tin content in the past, ranging from almost pure tin to a very common composition of 40 per cent tin and 60 per cent lead. Today, however, soft solders in wide use range from 20 per cent tin, 1 per cent silver, and 79 per cent lead to 97.50 per cent lead and 2.50 per cent silver.

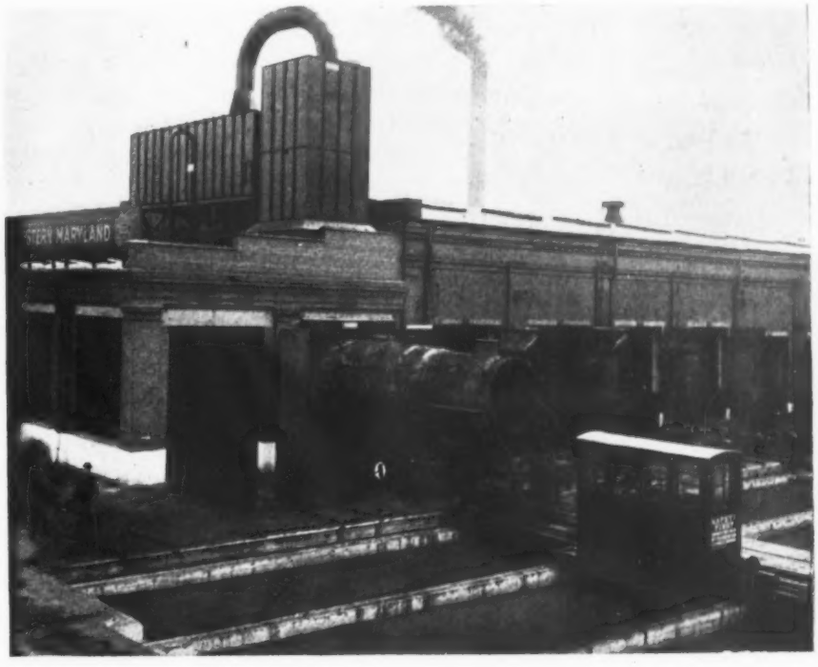
Substitutions of silver for copper are being made in brazing alloys, which require high temperatures for joining metals. One type of brazing alloy widely used before the war was composed mainly of copper, the remainder being silver and phosphorus. Now alloys with copper content as low as 16 per cent are in general use. A typical alloy consists of 50 per cent silver, 16 per cent zinc, 18 per cent cadmium, and 16 per cent copper.

Aside from saving tin by reducing the tin content of solders, brazing technique is now widely replacing soft soldering to conserve tin and copper. Chiefly because of the silver present, brazing is often quicker, more reliable, and economical. Soft soldering requires a separate operation—pretinning of points of contact—not necessary in brazing. Some types of soft soldering also utilize a clip or over-all metal band in binding two bars together, which can be eliminated in brazing.

Huge Blast-Cleaning Room for Locomotives

A huge steel-blast cleaning room, able to accommodate the largest locomotives, has been erected by the Pangborn Corporation, Hagerstown, Md., for the Western Maryland Railroad. The room is equipped with "day-bright" lighting and is ventilated by powerful blowers.

For cleaning purposes, the locomotives are stripped of all external parts and fittings, after which they are run into the blast-cleaning room, as shown in the accompanying illustration. The doors to the compartment are then closed and an elevator hood from the dust collector is lowered into position for the removal of all dust, after which two operators, clothed in protective rubber aprons and air-fed helmets, direct powerful streams of steel abrasive, propelled by compressed air from nozzles, over the metal parts to be cleaned. In less than two days, the entire job is completed, and the locomotive is ready for reassembly.



Blast-cleaning Room on the Western Maryland Railroad, with a Capacity Sufficient to Accommodate the Largest Locomotive Built

This work was formerly done by a crew of men with wire brushes and live steam. To complete the cleaning of a large locomotive required the steady services of an experienced gang of men for several weeks. With the new blast-cleaning room and equipment, a better cleaning job is done in a fraction of that time.

EDITORIAL COMMENT

Manufacturers can aid the war effort to a considerable extent by not ordering, or requesting the Government to order on their behalf, auxiliary equipment not immediately required for machine tools being bought. For example, there are instances on record where manufacturers have ordered collets for lathes to be used in war material manufacture in sizes from 1/64 inch to 1 3/4 inches by 1/64-inch intervals. Obviously, no manufacturer is going to need all these collets at this time. In fact, it is doubtful if any manufacturer would ever use all of these collet sizes. The placing of such orders results in loading up the collet manufacturer with work for a few concerns when, otherwise, he could fill orders for scores of war production plants.

Ordering Unnecessary Items Slows up War Production

Similar instances have been reported relating to taps and drills, where sizes that are not likely to be required at this time are being ordered, along with the sizes immediately needed. If those responsible for determining upon what is immediately required to carry on the war production program will carefully consider whether or not everything that is ordered is necessary for the war effort, many so-called "bottlenecks" would be removed, and industry in general could be supplied with auxiliary equipment and tools much more rapidly than is now the case.

* * *

On December 7, 1941, the automotive industry was the world's greatest single producer of civilian goods. Today it makes no cars except armored ones, and its trucks and buses are painted olive drab. Its output of aircraft, aircraft engines, propellers and parts, tanks, military vehicles, marine equipment, guns, ammunition, range-finders, and hundreds of other armament articles exceeds all expectations. According to the Automotive Council for War Production, this industry produces $20,000,000 worth of war goods every day, the annual rate at present being over $7,000,000,000, a rate that will be greatly increased later in the year. The value of its output is today 75 per cent above the best peacetime year—the industry's war record is even better than its past performance.

One reason for this remarkable showing of the automotive industry in the manufacture of all kinds of war equipment is due to the cooperation between the various companies in the solution of engineering, tooling, production, and other problems. The nation has gained immeasurably through this willingness of the nearly one thousand manufacturing firms that comprise the industry to forget that they were formerly competitors and to assist one another to the utmost.

An Industry that Still is Doing the Impossible

Instances of cooperative assistance range all the way from the interchange of rivets or nuts and bolts to the occasional borrowing and lending of management personnel, skilled in handling specific production problems. Most typical of the cooperative aspects, however, is the exchange of manufacturing information.

Formerly competing companies have pooled their research facilities and the specialized knowledge of their engineers, metallurgists, toolmakers, and mechanics. But back of all this is the spirit of enterprise and the managerial skill in coordinating brains, materials, and man power into a constantly increasing flow of war materials—abilities formerly used for peaceful purposes, but now devoted to the one end uppermost in all our minds—the winning of the war.

* * *

Free institutions depend but little upon the nominal form of government. The worst forms of autocracy today are found in countries that are not monarchies—that have no kings or hereditary rulers. Conversely, the most truly free institutions, under pre-war conditions, were found in several countries nominally ruled by kings, as well as in the leading republics. Under war conditions, a certain measure of arbitrary rule is necessary; but to preserve free institutions, any nation must be alert to the inroads on personal liberty that result, and must be ready to fight against bureaucracy as soon as the fight against the external enemy is over.

How Kaiser Builds Ships

Time-Saving Methods Used in the Pipe Shop of the Oregon Shipbuilding Co.—Final Installment of an Article on Kaiser Shipbuilding Practice

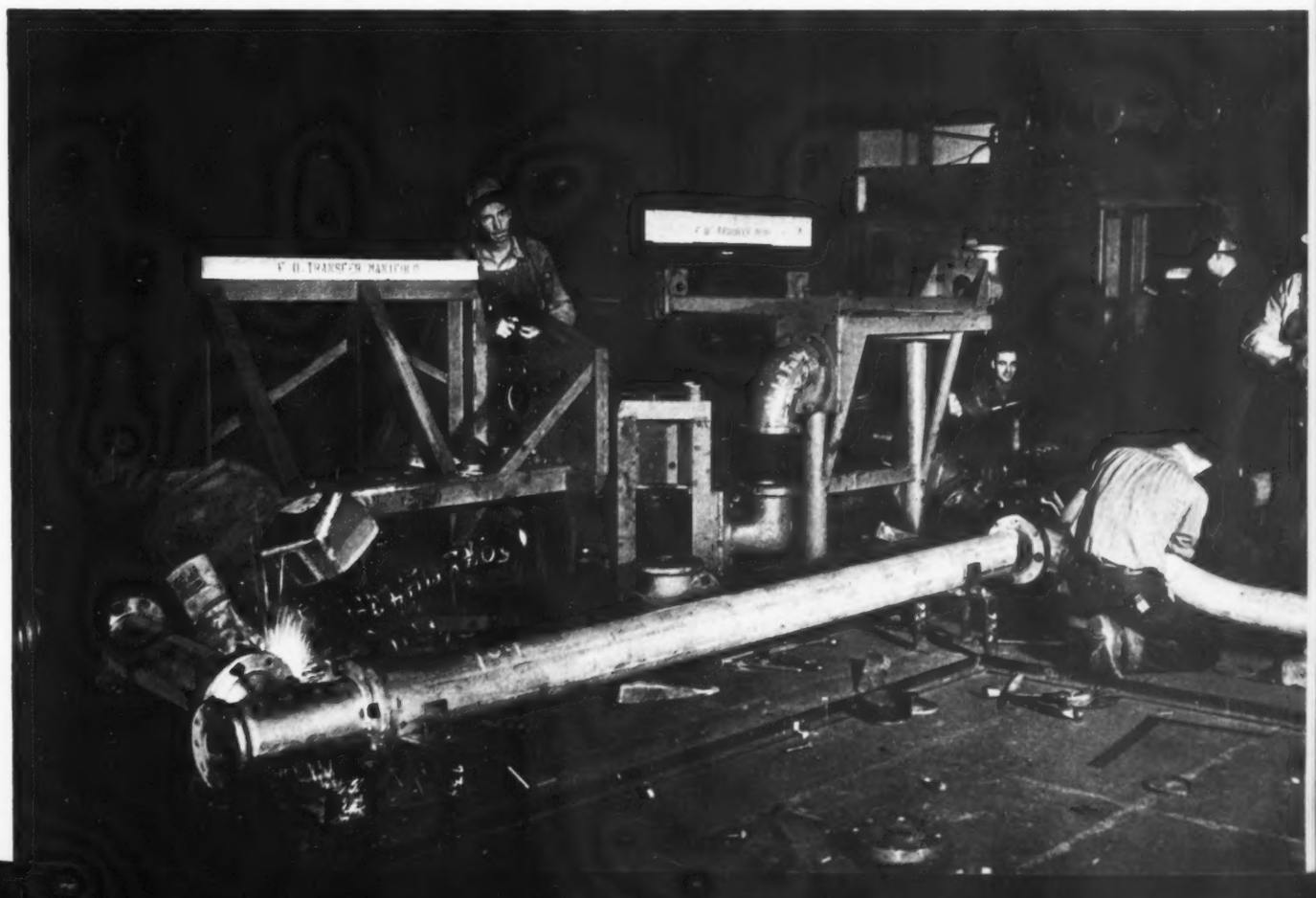
MANY of the shop operations performed at the yard of the Oregon Shipbuilding Co., Portland, Ore.—the Kaiser yard that holds the record of building Liberty Ships in only ten days from the laying of the keel to the launching—were described in an article published in November MACHINERY. Some of the spectacular time-saving practices followed in the pipe shop of that shipyard are described in the present article. The pipe shop is most important, in view of the fact that there are approximately eight and one-half miles of piping aboard each ship. The pipe used ranges from 1 to 14 inches in size, and is arranged aboard ship in thirty-seven systems.

Heretofore, the practice in shipyards was to bend, cut, and fit the pipe to blueprint specifications and then hoist it into the ship hulls, piece by piece, to be fitted, welded, and bolted in position. Quite often, variations in machinery space caused installation troubles, and in any event, fitting and welding had to be done under crowded conditions in many almost inaccessible places.

At the Oregon shipyard, pipe installation problems have been eliminated through the development of a plan under which practically all pipe is prefabricated and goes into the hulls in complete units that can be conveniently connected up.

To begin with, a 60- by 280-foot loft was converted into a full-scale model of the machinery space on a ship. A system of colored lines was painted on the floor to represent the systems of piping fabricated in the department. For example, red identified the fuel-oil transfer system; orange, the fuel-oil service pipe line; green, the bilge and ballast pipe line; blue, the salt-water suction and discharge line; and yellow, the boiler feed suction and blow line. The same colors are marked on the pipe before it leaves the department, and the units to which they are to be attached are marked in the same color.

Fig. 15. General View of a Set of Jigs Used in the Prefabrication of Piping to Enable it to be Installed aboard Ship with Minimum Difficulty



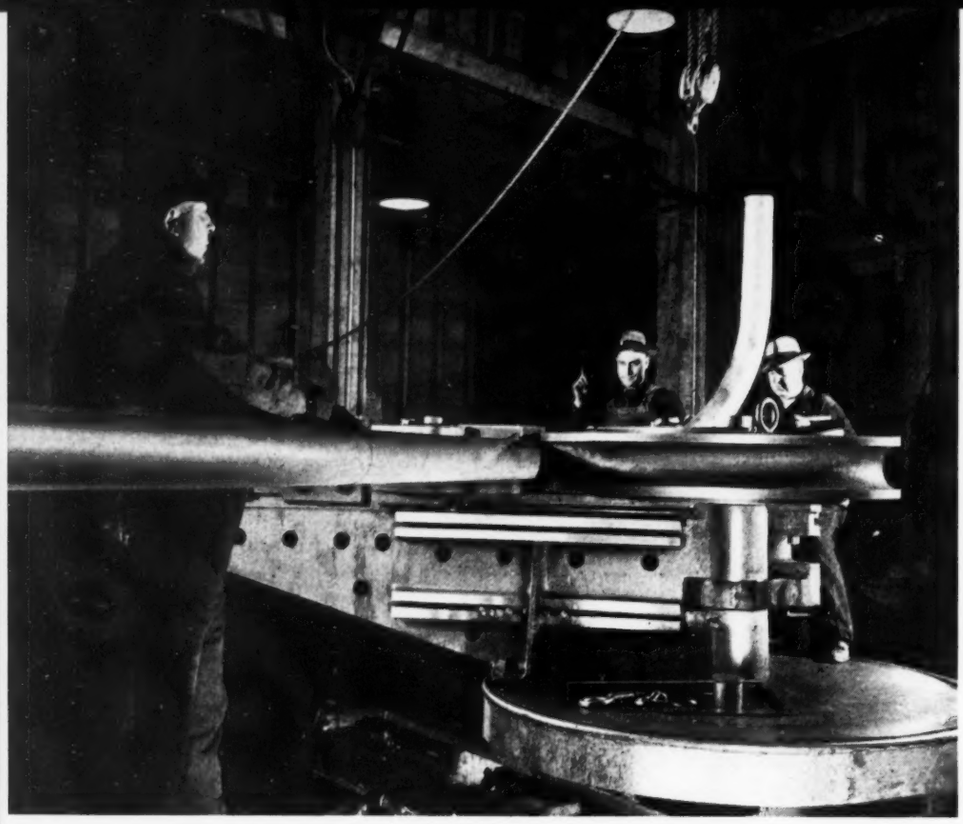


Fig. 16. Steel Pipes up to 6 Inches in Diameter are Bent Cold while Subjected to an Internal Water Pressure of 1200 Pounds per Square Inch

The second feature of this plan is the use of jigs which are made with openings and fittings to correspond with those of the ship's machinery and equipment. These jigs are constructed as shown in Fig. 15, and have the names of the units that they represent clearly indicated on them. The jigs are also painted to correspond with the piping system for which they are used. They are adjustable both vertically and horizontally to enable the workmen to make them conform with changes in ship specifications.

The group of jigs seen in the illustration is used in prefabricating one of the fuel-oil lines. The jigs represent the fuel-oil transfer pump, fuel-oil manifold, bilge and ballast suction manifold, and settling tank manifold, all of which are located in the same relation to each other as aboard ship. Pipe is fitted together, flanges are tack-welded in place, and all connections made while the pipe is in these jigs. After the pipe has been taken from the jigs, it can be transferred to the ship with the certain knowledge that installation can be made without difficulty.

About 85 per cent of the pipe-fitting previously done aboard ship is now done in the shop, and the welding time has been cut down almost 85 per cent. In addition, congested working conditions have been eliminated in the machinery space of unfinished hulls, and the hazard of welding fumes has been removed. There are

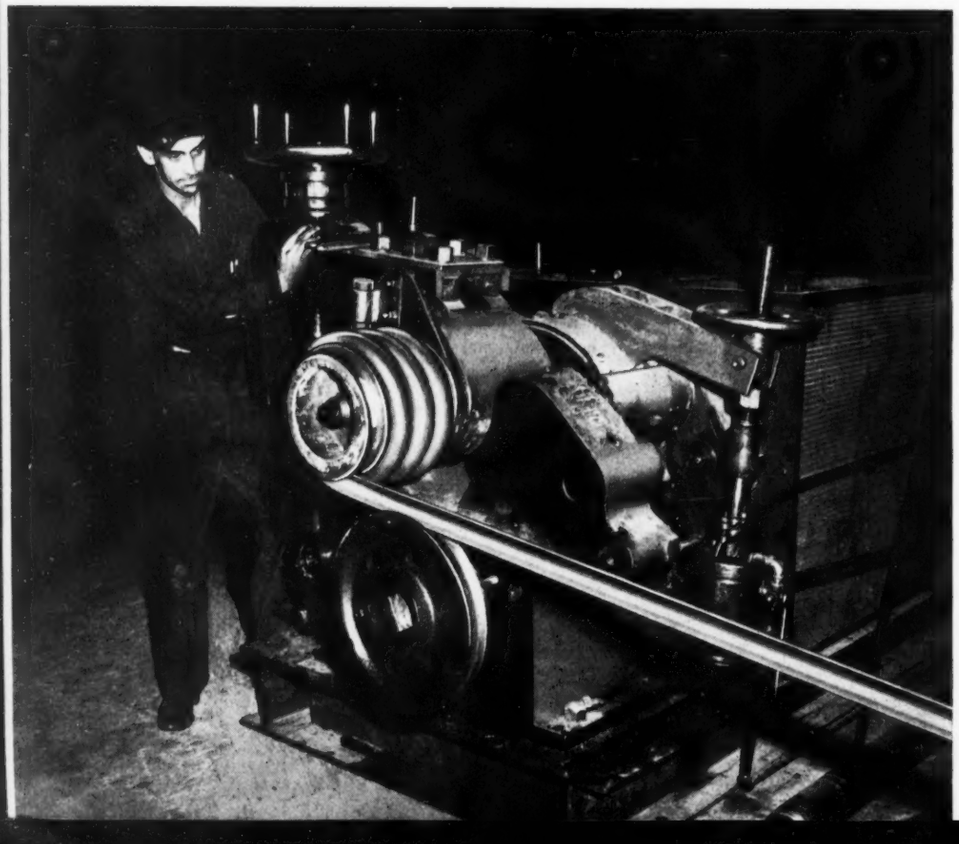


Fig. 17. Bending Spiral Heating Coil from Seamless-steel Pipe in a Machine Equipped with an Upper Multiple-groove Roll and a Lower Single-groove Roll which is Free to Slide Sidewise

Fig. 18. One of Two 8-inch Pipe Threading and Cutting Machines which are in Continuous Use in the Busy Pipe Shop of the Oregon Shipbuilding Co.

other important advantages, such as less transportation time and fewer losses due to breakage and pipe-fitting errors.

There are a number of United States pipe-bending machines in the pipe shop of the type shown in Fig. 16. The largest of these machines handles pipe up to 6 inches in diameter, and the smallest from 1 to 4 inches in diameter. All pipe is bent cold. In the case of the larger sizes, the practice is to plug one end of the pipe, and provide a fitting on the other end through which water can be supplied to create a pressure of 1200 pounds per square inch within the pipe. This prevents buckling on the inside of the curve when the pipe is bent.

In an operation, the pipe is gripped in a vise close to the point where the bend is to be made. Then an arm equipped with a form block having a groove of the same diameter as the outside of the pipe and made to the radius of the required bend, is swung around the pipe to bend it on the large form seen in the illustration. A graduated dial facilitates bending to any specified degree. It is, of course, possible to bend the same pipe in various planes, an overhead hoist being provided at each machine for manipulating the pipe between bends and for supporting projecting ends during an operation.

Spiral heating coils are produced on the Buffalo bending roll shown in Fig. 17, which is equipped for such an operation with an upper multiple-groove roll and a lower single-groove roll which is free to slide sidewise on a stationary shaft. In an operation, the end of the straight, extra heavy, seamless-steel pipe is slipped through a dog at the back of the top roll and over the bottom roll. Then, when the top roll is revolved the pipe is formed around the grooves of the top roll. To remove the finished coil, the end of the pipe is released from the dog on the top roll and this roll is revolved in the opposite direction so that the coil screws itself from the roll. Pipe from 1 1/4 to 5 inches diameter can be handled on this machine. The same equipment is also employed for bending pipe to extra large radii and for bending bull-ring brackets and similar parts.

There are four 4-inch pipe threading and cutting machines in this shop and two machines of 8-inch capacity. A Landis pipe threading and cutting machine that has just finished cutting the thread on an 8-inch pipe is shown in Fig. 18.

One of the jobs in the pipe shop that formerly consumed a great deal of time was the cutting of the hundreds of rubber and asbestos gaskets required on a ship. When produced by hand methods, one man could cut out an average of 250 gaskets per day. One of the pipe-fitters who had formerly been the publisher of a newspaper suggested that gasket production could be greatly expedited by the use of a platen job-printing press equipped with rule-type cutting dies. By purchasing an old press that had long reposed in a junkyard, the cutting of these gaskets has been speeded up to 1300 an hour.

The operation is illustrated in Fig. 19. Cutting dies, made of type-high cutting rules mounted on plywood bases, are fastened to the upper platen of the printing press. The gaskets to be cut are laid, one at a time, on the lower platen. In an operation, the lower platen swings upward to bring the gasket into contact with the die and the die is moved forward under pressure to cut through the gasket to a steel engraver's plate. At the time that the photograph was taken, gaskets about 12 inches outside diameter were being cut completely around the outside, and at the same time, a 4-inch hole was

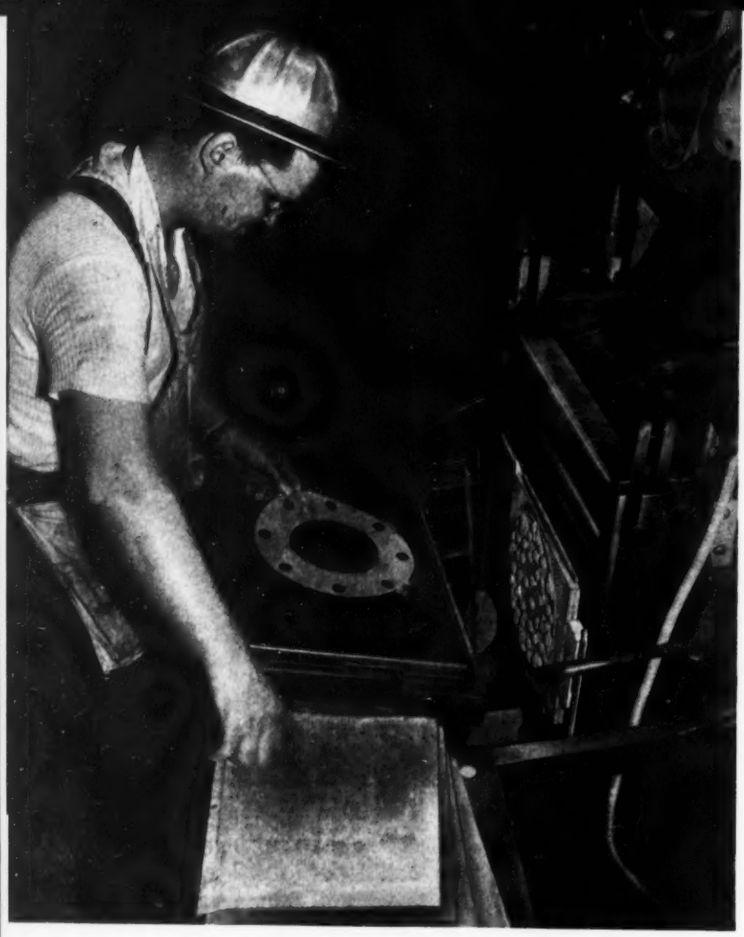


Fig. 19. Rubber and Asbestos Gaskets are Quickly Punched out from Rectangular Sheets by Employing a Platen Type Printing Press Equipped with Rule Type Cutting Dies

cut in the center and eight flange bolt holes were cut around the gasket. Plugs of cork are assembled on the die base inside of the cutting rules to act as ejectors for removing the gaskets from the die.

Mention has already been made of the efforts made to obtain minimum scrap in the plate shop. But considerable waste is bound to occur in any industrial plant unless close attention is paid toward its reduction. Therefore, a salvage department was set up at the Oregon shipyard which has a corps of men that comb the entire shipyard, the shops, the shipways and the launched vessels. Every bit of scrap metal is picked up and sent to a centralized department, where bolts and nuts are sorted according to size and rethreaded; lead pieces are remelted into standard bars; steel plates large enough for the cutting of any parts are returned to the plate shop; and rubber, asbestos, and other materials are assorted into separate piles. This department reclaims parts and materials every month that have a value as high as $100,000.

This concludes the description of the production methods followed in a typical Kaiser shipyard. There are other features, such as a vocational training department which prepares unskilled workmen for the performance of many duties that require careful training, as, for example, welding. There are, also, various morale building programs and entertainments for the purpose of increasing the sales of defense stamps and bonds, and of fostering a closer relationship between the management and the men.

Every second vessel launched from this yard is christened by the wife, daughter, or sweetheart of a workman whose name has been chosen by lot. The sponsors select the maids or matrons of honor and other members of the christening party. A quartette composed of members of the plant police force sing the National Anthem. There is a luncheon, flowers, and appropriate gifts. Launchings are held at the noon hour, so that all of the workmen can attend the ceremony which culminates their efforts on each vessel.

* * *

Great Increase in the Use of Aluminum Forgings

The tremendous increase in the output of various types of metal equipment is exemplified by the fact that the Aluminum Co. of America has increased its production of forgings to a volume twenty-five times that of 1938. The making of aluminum forgings was a comparatively new industry when the war in Europe started; now it is one of the important industries in the metal-working field. As many as one hundred and fifty different types of aluminum forgings are used in a single fighter plane, while a big bomber may have three hundred different types. The most familiar of these are propeller blades. Hundreds of thousands of these aluminum forgings have been delivered to propeller manufacturers, and production continues to climb to new highs.

* * *

Man-Power Required to Carry on the War Effort

According to the Office of War Information, by the end of 1943 over 60,000,000 people will be required to carry on the war effort of the United States. Close to 10,000,000 of these will be in the armed forces; 20,000,000 will be employed in the war industries; approximately an equal number will be occupied in work to provide the necessities for the civilian population; and some 8,000,000 people will be employed the year round in farm work. Several more millions will be required in miscellaneous occupations and professional services; and additional millions will be needed seasonally in the various agricultural areas.

Milling Fixture with Air-Operated Clamp

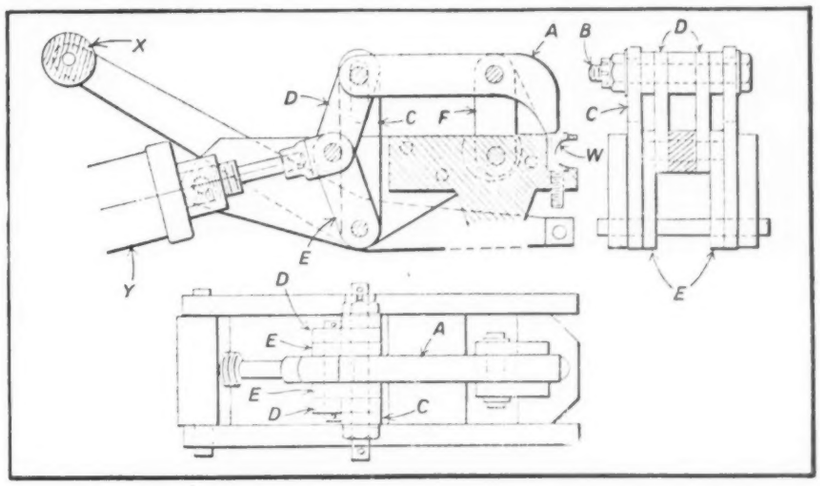
The equipment shown in the illustration is used in a British plant for holding a small piece *W* while a cut is taken with a form milling cutter. Work *W* comprises a pin with a threaded shank, as shown. A semicircular piece is milled from the pin to provide clearance for another part. The clamping pressure is supplied from the air cylinder *Y*, and lever *X* is provided for operating the ejector. The air cylinder is a commercial product.

The link mechanism by means of which the motion of the air piston is transmitted to the clamping finger *A* is of particular interest. The clamping finger is anchored to the body of the fixture by link *F*. At the rear end, it is held by pin *B*. This pin is free to slide in the vertical slots of links *C* and is actuated by links *D* and *E* to which the air-cylinder piston is attached.

The illustration shows the finger in its clamping position, where it holds the work down in the recess provided for it. When the air is exhausted from the cylinder, the piston is automatically withdrawn by spring pressure. The first action of the clamping finger in releasing the work is to pivot about the upper end of link *F* to relieve the pressure on the work. Pin *B* thus slides downward in the slots of links *C*. When it reaches the lower end of the slots, continued movement of the piston causes the clamping finger to be drawn backward and link *F* to pivot about its lower end.

In the same way, when air is admitted to the cylinder for clamping the next piece of work, the clamping finger first moves forward to its clamping position, and then pivots about the upper end of link *F* in applying the actual clamping pressure.

B. M.

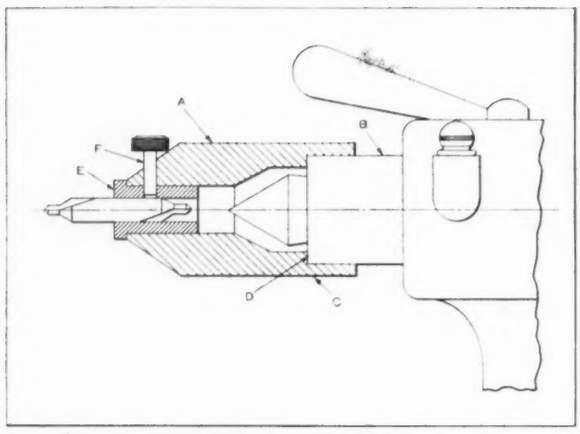


Milling Fixture with Air-operated Clamp for Milling Clearance in Part W

Center-Drilling Attachment for Tailstock

By D. E. McDONALD, New York City

A simple device for holding center drills of different sizes that permits center-drilling operations to be performed without removing the center from the lathe tailstock is shown in the illustration on page 194. The device consists of a shell *A*, which is a good sliding fit on the tailstock column *B* at *C*; an interchangeable bushing *E*, which is a sliding fit in shell *A* and a snug fit for the center drill; and a pin *F*,



Attachment that Permits Center-drilling without Removing Center from Tailstock Spindle

which keeps the bushing *E* and center drill from turning in shell *A*.

To center a piece of work, the shell *A* is simply slipped over column *B*, and the feeding pressure applied against shoulder *D* by turning the tailstock handwheel. Shell *A* is kept from turning by holding it with the left hand while feeding the drill into the work. As many interchangeable bushings *E* can be provided as required to accommodate the different sizes of center drills regularly employed.

Transparent Gage Checks Part for Blind Assembly

By ALEX S. ARNOTT, Toronto, Ontario, Canada

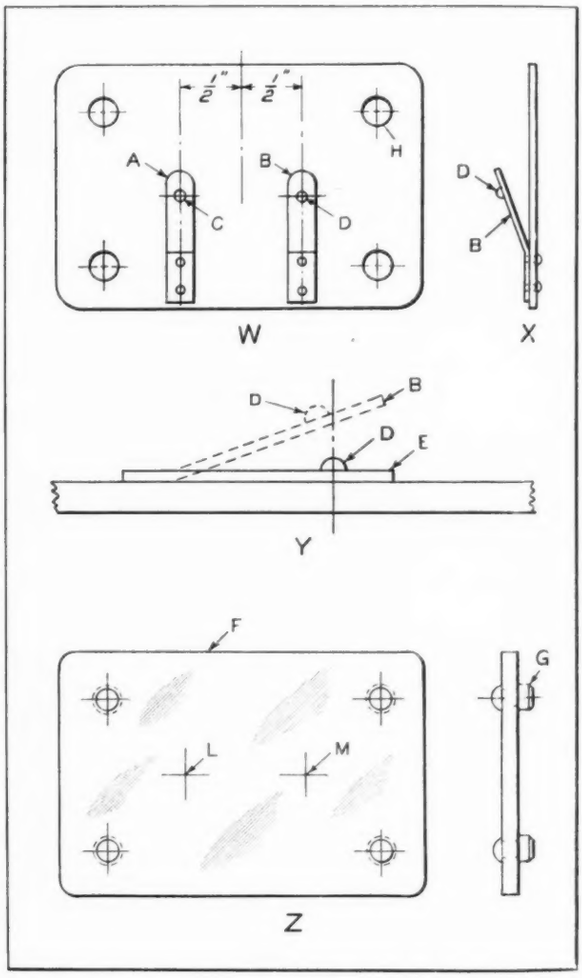
The use of transparent material in gages for checking the functioning of small parts is an innovation in gage construction that may be used to advantage in designing inspection gages for many small parts and assemblies. The idea should be especially useful in the instrument field and similar industries where accurate, yet inexpensive, functional gages are necessary.

The accompanying illustration shows the application of a transparent gage, designed as shown at *Z*, for use in checking the positions of contact points *C* and *D* on the cover plate *W*, when the latter member is assembled with the springs *A* and *B* pressed down against the under side of the cover, as indicated at *E*, view *Y*. When the cover *W* is thus assembled, the springs and contact points are hidden from view and the inspector cannot determine by visual means how accurately they align with their corresponding contact points in the assembly.

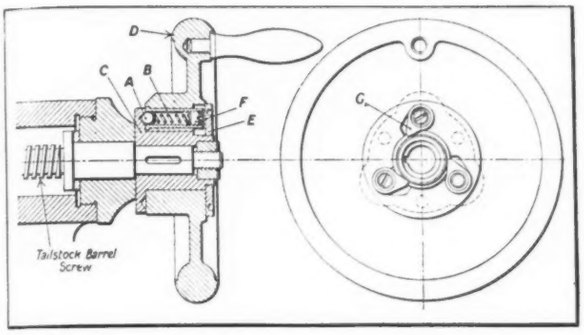
The aligning of the contact points when the springs are pressed down, as indicated at *E*, can be easily checked by means of the transparent gage shown at *Z*. This gage consists of a plate *F* of transparent material with four studs *G* correctly spaced and sized to fit the four holes *H* in cover *W*. Cross hair-lines scribed on plate *F* with their points of intersection at *L* and *M* indicate the exact points with which the centers of the contacts *C* and *D* should align when the cover plate is in the assembled position.

Thus, by simply placing plate *F* on cover plate *W*, with the studs *G* in holes *H*, and pressing the plate down until springs *A* and *B* are flat against the cover plate, as at *E*, view *Y*, the inspector can quickly check the positions of contacts *C* and *D* by looking through the transparent material to see whether they are in line with the points *L* and *M* on the gage.

The application of the transparent gage, in effect, consists of making an accurate replica of one member of an assembly from transparent material, so that the matching of all blind sections or parts of the non-transparent part to be checked with the master transparent member can be clearly observed.



Gage Z with Cross Hair-lines L and M in Transparent Plate F for Checking Positions of Contact Points C and D when Springs A and B are Pressed back against Cover W



Lathe Tailstock Handwheel Designed to Prevent Damage to Revolving Centers

Tailstock Handwheel Designed to Safeguard Revolving Centers

In using a ball- or roller-bearing tailstock center on an engine lathe, it is very easy to overload the bearing by applying too much pressure on the tailstock handwheel, since the mechanical advantage of the screw, combined with the turning movement applied to the handwheel, can produce a pressure exceeding the safe working thrust load of the revolving-center bearings. This may result in locking or damaging the bearings.

It was to eliminate this danger that the handwheel here described was designed. It is simple in construction and operation, and can be fitted to any size engine lathe without altering the screw of the tailstock barrel, the plain handwheel being merely exchanged for the safety handwheel.

Referring to the view at the left in the illustration, it will be noted that three spring-loaded steel balls *A*, placed in hardened steel bushings *B*, rest in 90-degree conical holes drilled in the flange of the free fitting bushing *C*, which is mounted on the outer end of the tailstock barrel screw in the usual manner. The handwheel *D* is mounted on bushing *C*, and is held in place by the circular nut *E*. The pressure on the steel balls is adjusted by means of screws *F*, which are a tight fit in the threaded portion of the bushings *B*. This arrangement provides a friction drive for use when the revolving center is being advanced toward the work, so that when correct contact is made, and a predetermined pressure has been reached, the balls will be forced out of the conical holes, allowing handwheel *D* to revolve on bushing *C*, thus indicating when sufficient pressure has been brought to bear on the roller-bearing center.

Three ratchet teeth are cut on the threaded end of bushing *C* to engage the pawls *G* carried on the ends of the bushings *B*. This arrangement provides a positive drive when the handwheel is reversed to turn the tailstock barrel for removal of the work, and is a necessary addition, because the barrel is prone to stick, even after the clamping device has been released, but is generally quite free once movement has commenced. This type of handwheel device has a distinct advantage over any form of direct compression-spring arrangement which may be incorporated in the tailstock barrel nut or on the screw itself.

* * *

Lincoln Electric Again Reaches Record Production Per Man

J. F. Lincoln, president of the Lincoln Electric Co., Cleveland, Ohio, points out, in a recent statement, that "a proper incentive wage system to boost the output of all types of labor, has, in the case of the Lincoln Electric Co., met with unusual success." In carrying out its early policy, the company, in December, made a special payment of nearly $3,000,000 to its employes covering unusual production. This payment was made for production records which have been so great that the total labor cost of the products made by the company is much less than that of any other manufacturer making a comparable product; the production in 1942 of Lincoln workers averaged over $30,000 per man.

Says Mr. Lincoln: "That this ability for a much greater output under proper incentive is latent in all individuals is obvious from the experience in all human activities.... The ten years experience of the Lincoln Electric Co. with incentive wage payments includes both war and peace production, panic and prosperity years. It has proved conclusively that such incentive payment, properly organized and properly applied, will result in progressively lower prices for the consumer, progressively higher wages for the worker, and progressively higher dividends for the owner.... This incentive is distributed approximately 90 per cent to the shop and office workers, and 10 per cent to management. If American industry is to retain its world industrial leadership, it can do so only through the tapping of these latent inherent capabilities of the American workman by a proper incentive system. Only so can the American standard of living be maintained in the face of world competition."

* * *

To win the war, the American people must practice economy. In business, as well as in private life, all unnecessary expenditures and all waste should be avoided. The average citizen must set a good example in this respect for his Government; for the Government, too, should learn to practice economy and avoid waste.

Broaching and Hobbing Engine-Starter Parts Having Dual Lead Angles

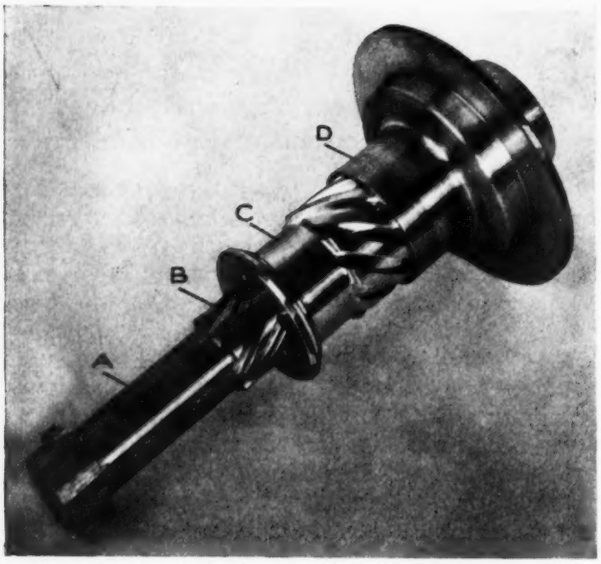


Fig. 1. Engine-starter Sub-assembly in which Helical Splines on Mating Parts are Produced by Broaching and Hobbing

AN unusual example of production possibilities obtainable by combining interlocking broaching and hobbing operations is presented by the combustion-engine starter sub-assembly shown in Fig. 1. Mechanisms of this general type have been used for some time in starting engines used in racing cars, aircraft, yachts, etc.

The sub-assembly consists of three members —an inner shaft *A* with a spiral spline *B* on one end; a middle member *C* into which the shaft is fitted; and a hub *D* mounted on the outside of member *C*. The hub is fitted to the middle member with a spiral spline having a lead angle the reverse of that used between the shaft and middle member. When the inner shaft and outer hub are held in such a manner as to prevent endwise movement, and rotation of the hub is also prevented, movement of the middle member in and out of full engagement of the splines causes rotation of the inner shaft. Since the lead angles between the parts are reversed, the amount of rotation is approximately doubled, compared with what would be obtained if only one spiral spline were used in conjunction with a straight spline. The mechanism thus converts straight-line motion into rotation.

To obtain freedom of longitudinal movement of the three mating parts for the entire length of travel, it is important that the specified helix angles of both internal and external splines be accurately maintained. The tooth form or contours and spacing of the splines also must be accurately reproduced, and close concentricity between the inner and outer splines of the middle member is necessary. It was decided that broaching was the only practicable method of cutting the internal splines to the required precision, while the external splines are cut with precision-ground hobs to close limits.

The broaching operations are performed on Colonial horizontal broaching machines equipped with helical drive attachments and broach guideheads and lead-bars to assure both conformance with the desired lead angle and concentricity. In general, therefore, the set-up is similar to that used for broaching the internal splines of automobile transmission gears.

The two externally splined parts are also produced on equipment similar to that used for transmission shafts. However, the greater length of the splines and the need for maintaining the helix angles on three instead of two parts make it necessary to perform the operations with greater precision.

The inner member *A* is turned from molybdenum-steel bar stock, and consists of a hollow

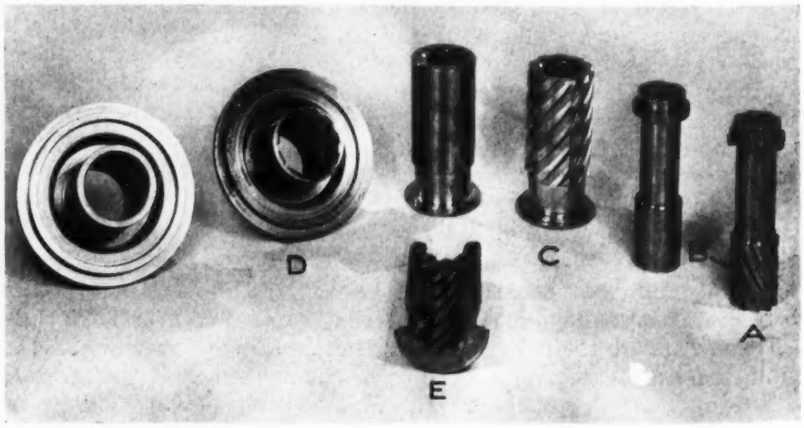


Fig. 2. Parts Comprising Starter Sub-assembly, Showing Halved Section of Middle Member C at E

Fig. 3. Hobbing Set-up for Machining External Helical Splines on Member C Shown in Figs. 1 and 2

Fig. 4. Broaching Splines in Hub D, Fig. 1, Using Machine with Guide Bars and Helical Drive Head

shaft on which a straight spline is cut on one end for attachment to a clutch. On the opposite end a helical spline *B* with a counter-clockwise twist is hobbed. The helix angle in the type shown is approximately 35 degrees, providing a lead equivalent to one revolution of the shaft for about 8 inches of travel. The length of this spline is 2 1/4 inches, and the over-all diameter is approximately 1 1/2 inches. The over-all length of the shaft is 6 1/4 inches.

This shaft is shown at *A*, Fig. 2, as it appears after being machined and splined. The limits on the external diameters of the finished spline are plus or minus 0.0025 inch.

The middle member *C* is produced from centrifugally cast high-tensile Ampco bronze, which is tough to machine. The internal spline in this member is broached in two passes. Different broaches are used for each pass, a roughing broach and a shorter finishing broach, rather than performing both roughing and finishing operations in a single pass. Both broaches are guided, as mentioned previously. Thus a double assurance of accuracy is provided. At the same time, the finishing broach can be made sufficiently long to provide for accurate finishing to the specified size. Broach cost is also reduced, since wear on the roughing broach does not affect the finishing operation. In turn, the amount of wear on the finishing broach is less, as the amount of metal it removes is small.

The middle member is also illustrated in Fig. 2, shown solid at *C* and in section at *E*, the latter view showing the part before the external spline is cut. The limits on the internal diameter of this part are plus or minus 0.0015 inch, and on the root diameter of the spline, 0.002 inch. The over-all length of the part is 5 1/2 inches.

The outside of the middle member is hobbed to produce ten splines, these having a clockwise helix, of the same lead as the inner spline. The clockwise lead, in combination with the counter-clockwise lead of the internal spline, provides a double amount of rotational motion of the inner member with reference to the hub, as noted previously. Since this part is more than 5 inches long and the lead angle is about one turn in 8 inches, approximately one and one-quarter turns are provided by sliding the inner members out of engagement. It is throughout this movement that minimum friction must be maintained without excessive looseness of one part within another. The limits on the outside diameter of the external spline are plus or minus 0.0025 inch. The hobbing operation on this part is illustrated in Fig. 3.

The outer part, or hub *D*, like the inner unit, is of forged molybdenum steel. Its internal spline, which mates with the middle member, is also broached, as illustrated in Fig. 4. For this operation, the broaching machine is equipped with a helical drive attachment and broach guide bars and head to assure correct lead, as in broaching the inner splines on the middle member. Two broaches are also used for this operation. The method of holding the outer member and the middle member is simple. Both members are placed in recessed cups centered in the faceplate of the horizontal broaching machine, and are held by clamping dogs to prevent any movement during the operations. The spline is 2 3/8 inches long, and the limits on the internal diameter are plus or minus 0.0015 inch.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Low Melting-Temperature Alloy for Proof-Casting of Cavities

The accurate proof-casting of cavities such as molds, gun chambers, and forging dies is now being accomplished by the use of "Cerrosafe," a low melting-temperature alloy made by the Cerro de Pasco Copper Corporation, 40 Wall St., New York City. "Cerrosafe" is a mixture of bismuth, lead, tin, and cadmium. It weighs approximately 0.35 pound per cubic inch, and is completely molten at 190 degrees F.

One of the advantages of this alloy is that, although shrinkage takes place during solidification and cooling to room temperature, this is partially compensated for by growth which subsequently takes place. Two hours after reaching room temperature, the shrinkage is only 0.0008 inch per inch, and by the end of twenty-four hours, this has been reduced to 0.0003 inch per inch.

Small castings are proof-cast with solid castings of "Cerrosafe," while wood cores may be used to materially lessen the weight of medium and large castings. Other applications of this alloy are as a filler behind delicate parts to be machined or ground in profiling or duplicating machines, and as accurate models for engraving machines in cases where the pressure of the stylus is low. It can also be used for protecting wood core molds and patterns. When so employed, it is applied by means of a low-temperature spray gun over two coats of shellac used as a binder. Core molds and patterns so protected have a life almost equivalent to that of solid metal patterns. 201

Durez Phenolic Plastic Suitable for High-Impact Service

A new high-impact plastic of the phenolic type has been announced by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. Increasing demands for heavier duty molding compounds to replace vital materials in war production are responsible for the development of this new plastic, known as Durez 11934. A macerated fabric filler is used, and consequently the material does not readily preform. It has an impact strength of 2, a specific gravity of 1.44, and is said to have a very good cure cycle for a material of this type. Durez 11934 is designed to meet the special impact requirements of such applications as small pulley wheels, casters, rollers, etc. 202

Water-Absorbing Oil for Cleaning Steel Surfaces

A new light oil made by the Curran Corporation, Malden, Mass., is claimed to have the property of completely removing perspiration, water, oil, and dirt from iron or steel surfaces. This oil, designated as "Polar R," is said to be superior to alcohol for dehydrating and cleaning steel surfaces, bearings, or similar parts that have become wet or have been left covered by a film of coolant. It is especially applicable for protecting, during storage, the water side of steam turbines, water pumps, meters, and steel parts that may have been exposed to plain or salt water.

The oil is completely soluble in hydrocarbon and lubricating oils, and no subsequent cleaning procedure is necessary to remove the thin film formed on the steel surface. Any perspiration that may be on iron or steel surfaces not only is neutralized, but also increases the rust preventive property of the protective film.....203

Surface Dye Provides Clear Lay-Outs on Sheet Metal

The Acme White Lead & Color Works, 8250 St. Aubin Ave., Detroit, Mich., has announced a new product that is said to provide a quick and easy solution to the problem of making sharp, clear lay-outs on sheet metal. This product, known as the "Acme Quality Industrial Finish" lay-out dye, is semi-transparent, extremely fast drying, and purple in color. When brushed on the sheet metal, it dries in about a minute. The lay-out is then scribed on the stock with a sharp-pointed stylus or similar tool. Bright metal

To obtain additional information about materials described on this page, see lower part of page 202.

shows through the purple dye where the scratch lines are made, producing a sharp, clear pattern.

When the work on the sheet metal has been completed, the remaining dye may be quickly and easily washed off with a rag soaked in denatured alcohol. The film of dye is so thin, however, that in many cases there is no need to remove it. 204

Low Tin-Content Babbitt as War Substitute

A new tin-saving babbitt metal has recently been placed on the market by the National Bearing Metals Corporation, 4930 Manchester Ave., St. Louis, Mo. This product, known as "Rex" babbitt metal, complies with the government tin conservation order M-43-a, which restricts the tin content of all babbitt metals to 12 per cent, except for implements of war or for special circumstances.

The properties of the new Rex babbitt compare favorably with those of the former high tin-base babbitts. They are as follows: Tensile strength, 8200 pounds per square inch; elongation, 1.2 per cent in 2 inches; reduction in area, 1.8 per cent; compressive strength, 17,500 pounds per square inch; specific gravity, 9.60; Brinell hardness, 25; and proper pouring temperature, 625 to 675 degrees F.

The manufacturers of the new babbitt have submitted it to rigid tests, and state that it will do a creditable job as a substitute for high tin-base babbitt if the lining is properly applied and the bearings are carefully fitted and lubricated. 205

New Vinylite Resin Improves Adhesion of Industrial Finishes

A new and improved type of vinyl resin for corrosion-resistant maintenance finishes and other coating applications has been announced by the Plastics Division of Carbide and Carbon Chemicals Corporation, unit of Union Carbide and Carbon Corporation, New York City. The new resin, identified as Vinylite resin VMCH, is characterized by remarkably improved adhesion to a wide variety of surfaces, making possible the formulation of air-dry or low-bake coatings which possess the same resistance to corrosive chemicals, moisture, and extreme weathering as has been shown by baked finishes based on the Vinylite vinyl chloride-acetate resins.

The new resin is quite similar to the vinyl chloride-acetate resins in most of its properties, and differs only in containing a small amount of an additional ingredient that promotes adhesion. It is completely compatible with the other grades, and may be blended with them in actual use.

The major fields for finishes based on the new resin are expected to be in air-dry coatings for maintenance work, coatings for industrial buildings and equipment exposed to very corrosive atmospheres, coatings and linings for storage tanks to hold petroleum products, acids, chlorides, or other corrosive materials, and coatings that must withstand prolonged water soaking or extreme weathering conditions. Test finishes based on this resin show excellent performance when applied over magnesium and aluminum alloys, particularly when subjected to salt water immersion. 206

Zinc-Coated Steel Sheet Introduced as War Substitute

A new addition to the line of plated metals produced by the American Nickeloid Co. of Peru, Ill., is electroplated zinc on steel, a satisfactory substitute for pure nickel, tin, chromium, aluminum, or stainless steel. The zinc coating makes the sheet highly resistant to corrosion and rust. Zinc and steel bond well, so that the resultant product is readily bent, stamped, formed, drawn, soldered, and spot-welded to meet most production requirements.

The new zinc-plated metal is available at the present time in sheets only. These range in size up to 36 by 96 inches in a full range of gages and tempers, and in polished, unpolished, and satin finishes. The thickness of the coating can be varied to meet the requirements and specifications of each application. 207

Non-Aqueous Degreasing Solvent for Use in Finishing Processes

"Cyclodiene Hydrocarbon," a non-aqueous degreasing solvent, is being manufactured by the Colonial Alloys Co., E. Somerset St. and Trenton Ave., Philadelphia, Pa., for use in connection with plating, painting, Parkerizing, anodizing, or other finishing processes. In use, the work is dipped into the solvent at room temperature, and when removed, it is thoroughly degreased. A thin protective film, which is rust-inhibitive, remains on the work, and this evaporates in about twenty minutes. The evaporation of this film can be accelerated by a dip into hot water or methanated hydrocarbon.

In accordance with the standards of the U. S. Bureau of Explosives, this material is considered to be non-flammable and non-explosive. Open wooden or steel tanks can be used as containers, as well as standard degreasing machines. . .208

To obtain additional information about materials described on this page, see lower part of page 202.

NEW TRADE LITERATURE

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 201 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the February Number of MACHINERY

Testing Machines with High-Magnification Recorders

TINIUS OLSEN TESTING MACHINE CO., 500 N. 12th St., Philadelphia, Pa. Bulletin 24, descriptive of Olsen electronic high-magnification recorders applied to Olsen universal testing machines for producing stress-strain diagrams in production testing with research accuracy. Typical stress-strain diagrams are shown. 1

Multiple Thread Milling Cutters

BARBER-COLMAN CO., 203 Loomis St., Rockford, Ill. Bulletin entitled "Facts about Multiple Thread Milling Cutters," containing information on the ordering and use of these cutters for war production work. The booklet explains what things are responsible for difficulty in the manufacture of thread milling cutters and what may cause inefficient operation. 2

Hydraulic Tables

BALDWIN SOUTHWARK DIVISION OF BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. Bulletin 150, containing hydraulic tables and other data for those engaged in the design or use of hydraulic equipment, especially those structures involving the use of hydraulic pressures for load-producing purposes. 3

Brush-Spring Design Data

INSTRUMENT SPECIALTIES CO., INC., Little Falls, N. J. Bulletin 5 entitled "Better Brush Springs," containing information on Microprocessed beryllium-copper brush springs. The first part of the book gives helpful hints for the user, and the second data and formulas of value to the designer of brush springs for small motors. 4

Oilseals and Greaseals

GITS BROS. MFG. CO., 1858 S. Kilbourn Ave., Chicago, Ill. Bulletin giving detailed information, recommendations, applications, diagrams, listings, prices, etc., covering the line of Gits Oilseals and Greaseals, applicable in aircraft, motorized units, and practically every branch of industry. 5

Cleaning Methods in the Aviation Industry

OAKITE PRODUCTS, INC., 26 Thames St., New York. Manual containing much helpful information for aircraft executives on cleaning materials and methods applicable to the aviation industry. Many new developments are described. 6

Automatic Electric Control

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalogue N-00A, descriptive of Micromax automatic electric control equipment, capable of handling any process that can be controlled by positioning a valve or other regulating device. 7

Manganese Steel

AMERICAN MANGANESE STEEL DIVISION OF THE AMERICAN BRAKE SHOE & FOUNDRY CO., Chicago, Ill. Bulletin 1142-SM, containing information on the properties of manganese steel and its use in the steel industry for blast-furnace, coke-plant, rolling-mill, and foundry-equipment parts. 8

Steels

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Publication commemorating the one-hundredth anniversary of the company, the history of which parallels the industrial growth of the United States during the past century. 9

Drive Control

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin B-3123, entitled "A Challenge to Designers of Drive Control," describing how the Rototrol increases the speed range and keeps the speed of a direct-current motor constant, regardless of load variations. 10

Drilling Machines

BRYANT MACHINERY & ENGINEERING CO., 400 W. Madison St., Chicago, Ill. Catalogue 400, containing complete descriptions and illustrations of Cleereman drilling machines, designed to produce accurate holes at high speed and low cost. 11

Aircraft Chain and Sprocket Handbook

DIAMOND CHAIN & MFG. CO., Indianapolis, Ind. Engineering Handbook 641, giving complete information on the selection, installation, and maintenance of precision, roller type chains and sprockets for aircraft use. 12

Pneumatic Holding Devices

ANKER-HOLTH MFG. CO., 332 S. Michigan Ave., Chicago, Ill. Catalogue covering the line of "Air-grip" air-operated universal chucks, shell-holding equipment, stationary

cylinders, and revolving air cylinders. 13

Vertical Turret Mills

ROGERS MACHINE WORKS, INC., 133 Arthur St., Buffalo, N. Y. Bulletin 431, on Rogers "Perfect 36" vertical turret mills for boring, drilling, and turning, including specifications for both standard and high-speed models. 14

Machinery Steels

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Folder containing information on the Max-El machinery steels made by this company, covering properties, composition, and typical applications. 15

Zinc in War Products

NEW JERSEY ZINC CO., 160 Front St., New York City. Folder entitled "Zinc in War—from Mine to Battle Front," describing, step by step, the production of zinc war products. 16

Precision Tapping Machines

DETROIT TAP & TOOL CO., 8432 Butler St., Detroit, Mich. Bulletin covering the company's line of high-precision tapping machines, made in both light- and heavy-duty series. 17

Grinding Compounds

WOLFE-KOTE CO., 2224 N. 7th St., Sheboygan, Wis. Circular descriptive of "Ever-Drest," a grinding wheel dressing compound said to permit greater grinding efficiency with less tension on the wheel. 18

Precision Collets and Feed-Fingers

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletins containing data on Hardinge precision power spring collets and feed-fingers for Brown & Sharpe machines, designed to simplify ordering. 19

Automatic Duplicator Milling Machine

DETROIT UNIVERSAL DUPLICATOR CO., 723 E. Milwaukee Ave., Detroit, Mich. Circular entitled "Duplimatic Puts Standard Horizontal Boring Mill on Automatic Production Basis." 20

Electrodes

STEEL CO. OF CANADA, LTD., Hamilton, Canada. Circular entitled "An Amazingly Simple Technique in Arc Welding Conserves Steel, Saves Time, and Reduces Costs," describing the use of Stelco full-fluxed electrodes. 21

Corrosion-Resistant Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin T-9, containing technical information on "K" Monel, including composition, properties, and working instructions. 22

Optical Locating and Centering

CENTER SCOPE INSTRUMENT CO., 351 S. La Brea Ave., Los Angeles, Calif. Bulletin describing methods of using the Center Scope for optical locating and centering. Many different applications of this instrument are shown. 23

Pinion- and Gear-Cutting Machines

WALTHAM MACHINE WORKS, Newton St., Waltham, Mass. Bulletin 112, descriptive of Waltham motor-driven improved pinion- and gear-cutting machines. 24

Transformers for Power and Lighting Circuits

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin 5205, on dry type transformers for power and lighting circuits of 600 volts and lower. 25

Coolant Pumps

ATLAS PRESS CO., 153 N. Pitcher St., Kalamazoo, Mich. Catalogue C43, describing the construction of the new Atlas coolant systems, and giving pumping capacities for various equipment. 26

Open-Hearth Carburizing Steels

W. J. HOLLIDAY & CO., Indianapolis, Ind. Bulletin 942, on "Speed Case" and "Speed Treat" open-hearth case carburizing steels with free machining properties. 27

To Obtain Copies of New Trade Literature

listed on pages 200-202 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Machine Tools for War Production

GREENLEE BROS. & Co., Rockford, Ill. Catalogue entitled "Greenlee at War," showing examples of the many types of tools and machines produced by this company for making war products. 28

Hydraulic Presses

BALDWIN SOUTHWARK DIVISION OF BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. Bulletin 160, describing Southwark high-speed hydraulic presses. 29

Gear and Wheel Pullers

ARMSTRONG-BRAY & Co., 5364 Northwest Highway, Chicago, Ill. Circular descriptive of a new Steelgrip rigid-arm gear and wheel puller. 30

Ampco Metal

AMPCO METAL, INC., Milwaukee, Wis. Circular describing three bronzes (or new grades of Ampco metal) alloyed especially for the Victory Program. 31

Solenoids

HERCULES ELECTRIC & MFG. Co., 2416 Atlantic Ave., Brooklyn, N. Y. Circular on three-phase heavy-duty solenoids for pulls up to 200 pounds, or more if required. 32

Aircraft Tools

PRODUCTS ENGINEERING Co., Los Angeles, Calif. Catalogue 4, covering the line of tools made by this company for use in the aircraft industry. 33

Universal Turret Lathes

INTERNATIONAL MACHINE TOOL CORPORATION, FOSTER DIVISION, Elkhart, Ind. Circular F5-42, illustrating and describing in detail the Foster No. 5 universal ram type turret lathes. 34

Jig Boring Machines

BRYANT MACHINERY & ENGINEERING Co., 400 W. Madison St., Chicago, Ill. Catalogue 300, illustrating and describing the Cleereman jig borer. 35

Etching Stamps

JAMES H. MATTHEWS & Co., Pittsburgh, Pa. Bulletin S, illustrating and describing a new type of etching stamp for use in inspecting and identifying work. 36

Horn Presses

E. W. BLISS Co., 53rd St. and Second Ave., Brooklyn, N. Y. Catalogue covering Bliss, Toledo, and Consolidated horn or adjustable-bed presses. 37

Pneumatic-Tired Trucks

WILLAMETTE HYSTER Co., Portland, Ore. Circular announcing a new 75 pneumatic-tired lift-truck for handling war materials, particularly over unpaved surfaces. 38

Safety Switches

SQUARE D Co., 6060 Rivard St., Detroit, Mich. Bulletin 500, listing all types of Square D safety switches for industrial applications. 39

Precision Gages

PERFEX GAGE & TOOL Co., 3603 Gaylord Ave., Detroit, Mich. Bulletin describing how Perfex precision gages are inspected under temperature control. 40

Precision Gage-Blocks

DEARBORN GAGE Co., Dearborn, Mich. Booklet containing suggestions on how to care for precision gage-blocks in order to preserve their usefulness. 41

Anti-Spatter Welding Compound

WOLFE-KOTE Co., 2224 N. 7th St., Sheboygan, Wis. Circular outlining advantages of a new "anti-spatter" welding compound. 42

Arc-Welding Accessories

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-3295, entitled "Arc Welding Accessories for Women." 43

Tool Chests

GEORGE SCHERR Co., INC., 128 Lafayette St., New York City. Circular containing data on machinists' tool chests. 44

To Obtain Additional Information on Shop Equipment

Which of the new equipment described in the Shop Equipment News Section, beginning on page 203, is likely to prove advantageous in your shop? To obtain additional information about such equipment, fill in below the number found at the end of each description—or write to manufacturer, mentioning machine as described in February, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 198-199, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning name of material as described in February, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

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Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Fastermatic Turret Lathes Designed for Automatic Machining Cycle

The International Machine Tool Corporation, Foster Division, Elkhart, Ind., has added two new models—the Nos. 1-F and 2-F—to the line of Fastermatic turret lathes. Since the entire machining cycle of these new machines is automatic, the operator need only concern himself with loading and unloading the work, and can thus attend to several machines.

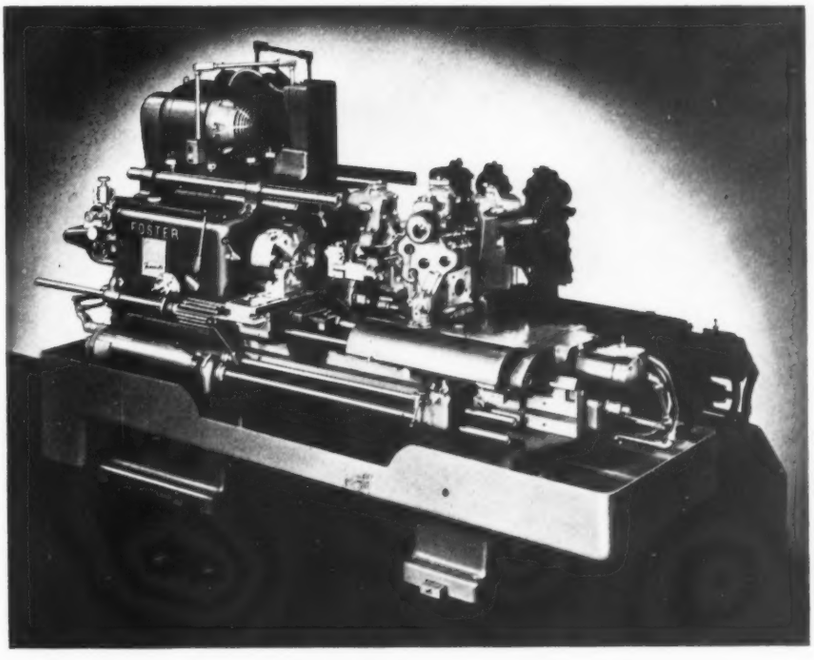
These Fastermatic machines are equipped with a flexible hydraulic system which provides an independent feed for each face of the turret. For this reason, no time is lost in changing over from one cut to another. Standard tools are available for most work, and standard cams, adjustable for controlling the various movements or for changing the operating speed, are provided.

Multiple cutting and various combinations of machine movements can be readily obtained through the flexible hydraulic feeding mechanisms. These mechanisms are built into the machine as a unit, and the pump that operates the controls is mounted inside the bed and is driven by double solid roller chain from the main driveshaft. The coolant pump is also driven from this shaft. The Oilgear unit which supplies the oil pressure that controls all feeding operations of the machine is also mounted in the bed below the headstock. Oil pressure adjustable from 300 to 1000 pounds per square inch is provided, and the maximum rapid traverse pressure of 300 pounds per square inch is adjusted at the factory.

Clean oil free from abrasive particles is assured in the hydraulic control system by an oil filter. Ample power for the hydraulic feeds of the entire machine is provided by one large powerful hydraulic cylinder. The motion of the hexagonal turret-slide provides the necessary feed to the front and rear cross-slides by means of cams. The forward and reverse movements of the hexagonal turret-slide indexes the turret and cam roller.

The cross-facing attachment is operated by means of a hydraulic cylinder mounted beneath the cross-slide at the rear of the machine. Adjustments are provided for setting the machine for a wide variety of cross-facing operations. Any group of automatic speeds within the range of these machines can be quickly obtained by using the proper set of pick-off gears. The 1-F Fastermatic has twenty-seven spindle speeds ranging from 22 to 332 R.P.M., while the 2-F machine has twenty-eight spindle speeds ranging from 17 to 263 R.P.M. Higher speed ranges can be supplied when required. Speed changes can be made automatically at any time during the cut or at the end of the turret stroke.

The operator has only to move the large lever on the headstock to the left to engage the main drive clutch controlling the spindle rotation. In the left position, the spindle is in neutral and a powerful disk brake serves to stop the spindle quickly. In the central position, the spindle is in neutral and free to be turned by hand which assists the operator in chucking a new piece. After loading the machine, the starting lever on the hexagonal turret is pulled back, causing the machine to go through its automatic cycle.



Fastermatic Turret Lathe Designed to Permit One Man to Operate Several Machines

To obtain additional information on equipment described on this page, see lower part of page 202.

The 1-F Fastermatic is furnished with either a 7 1/2- or a 10-H.P. motor, while the 2-F Fastermatic is supplied with a 10- or a 15-H.P. motor, depending upon the nature of the work to be handled. The standard motors have a speed of 1800 R.P.M. and maintain the driving shaft speed of 1040 R.P.M. Multiple V-belts, the number determined by the power to be transmitted, are provided. An automatic safety control is furnished, which opens the circuit on the main drive motor in the event the operator accidentally leaves the machine set for either the forward or reverse quick traverse. Constant headstock temperature is maintained by a Thermalign unit to insure precision alignment of the spindle with the turret-hole centers. The air-operated chucks are furnished in two- and three-jaw styles. 51

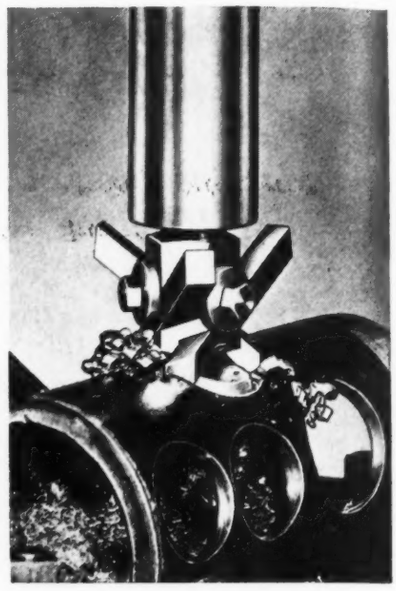
Wickes Heavy-Duty Crankshaft Lathe

A heavy-duty universal crankshaft lathe—Model UH-60—has just been announced to the trade by Wickes Brothers, Saginaw, Mich. This lathe, as shown in the illustration, is of the single-end drive type, and is designed for machining the intermediate main line bearings and ends of heavy-duty Diesel type crankshafts having line bearings up to 8 or 10 inches in diameter.

The back roller-rest supports the bearing being machined, and thus prevents deflection of the crankshaft. This rest is carried in a very heavy back tool housing, and can be moved along the lathe bed to any position. The heavy-duty four-roller steadyrest, also shown on the lathe, was used for supporting a main line bearing previously machined.

A three-way turret is mounted on the cross-slide, and tooling equipment is provided for turning, cheek-facing, and fillet-turning operations. The lathe has hydraulic longitudinal feed to the carriage and hydraulic feed to the cross-slide. The hydraulic feed ranges from 0.005 to 0.125 inch per revolution, the changes in feed being obtained by means of a variable-delivery hydraulic pump. The main drive motor and the feeds and rapid traverse are all controlled from electric drum switches on the apron. The tailstock is movable along the lathe bed for machining various lengths of crankshafts.

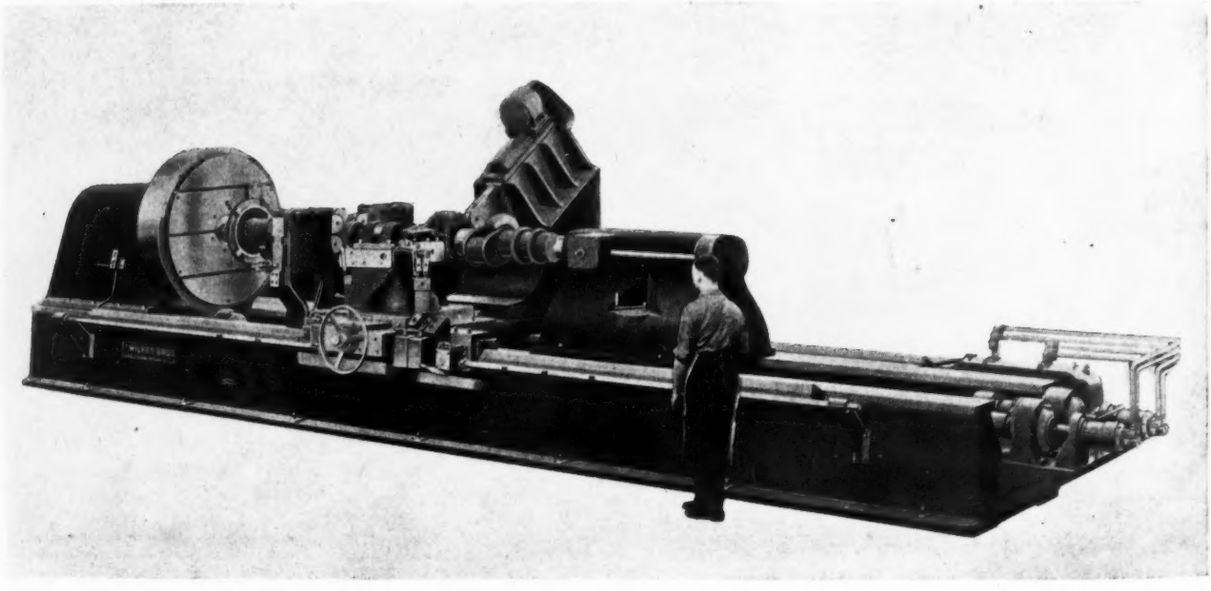
This lathe has a swing over the bed of 61 inches and a swing over the cross-slide of 36 inches. The machine shown will take crankshafts up to 16 feet in length, although the lathe beds can be made of any length desired. The weight of the machine shown, with a 29-foot bed, is 69,000 pounds. The main drive motor, of 30 H.P., is of the adjustable-speed type. 52



Adjustable-blade Hole-cutting Tool

Clark Hole-Cutter

A hole-cutting tool designed for use in electric drills, pneumatic motors, drill presses, lathes, milling machines, or any machines accommodating Morse-taper or straight-shank tools has been developed by the Robert H. Clark Co., 3424 Sunset Blvd., Los Angeles, Calif. This tool is regularly made in six sizes for cutting holes ranging from 3/4 inch to 4 1/2 inches in diameter in metals, plastics, hard fibers, pressboard or wood, either in thin sheets or 3/4-inch plates. 53

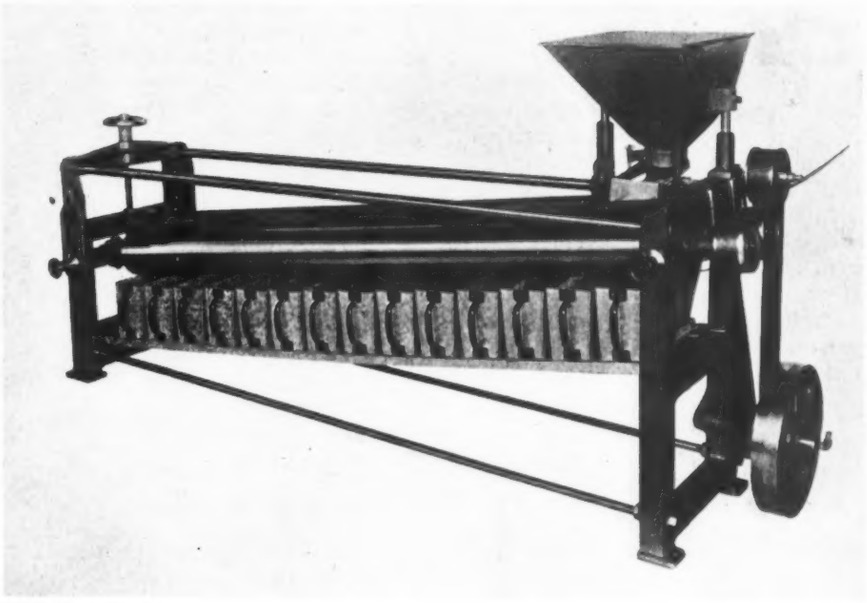


Wickes Crankshaft Lathe Equipped for Machining Bearings of Diesel-engine Crankshaft

To obtain additional information on equipment described on this page, see lower part of page 202.

Armor-Piercing Core Diameter Gaging Machine

A machine designed for classifying 0.30- and 0.50-caliber armor-piercing cores, where close tolerances are demanded in grading the work as it comes from the automatic screw machines, has been brought out by the Barry Co., Inc., Chicago, Ill. This machine consists of a sturdy frame supporting two rolls 5 1/2 inches in diameter and 6 feet in length, which are made of cold-drawn steel tubing having 3/8-inch walls, which are chromium-plated on their outer surfaces to insure long wear. The ends are turned on the inside to receive the plugs and stub shafts which run in self-aligning bearings, and which can be easily adjusted laterally to control the space and angle between the two rolls.



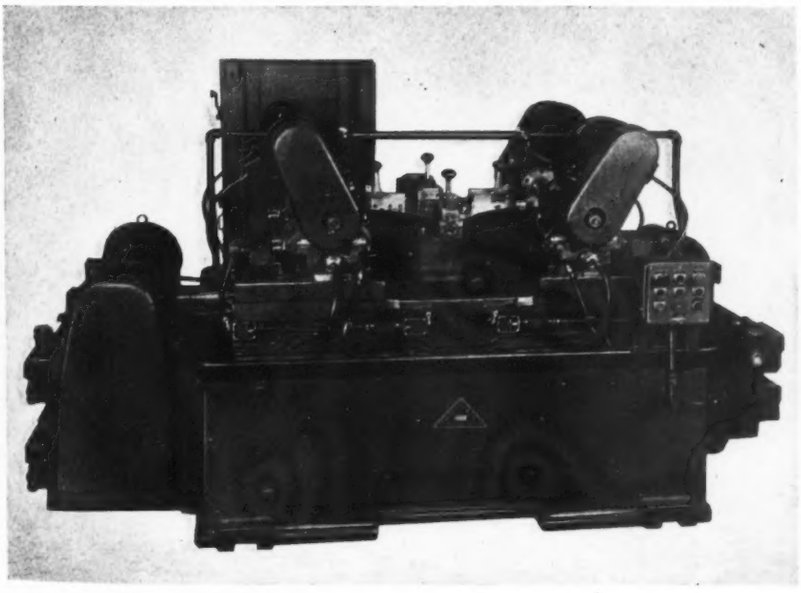
Barry Gaging Machine for Armor-piercing Cores

The longitudinal angle of the rolls is adjusted by turning the handwheel at the discharge end, which serves to raise and lower a sliding frame. This adjustable frame also carries the roll bearings. The discharge spout of the hopper passes into a mechanically driven feeding funnel which controls the delivery of the cores at a uniform speed to the rolls for gaging or classification. Fourteen receiving pans provide fourteen classifications of diameter with a varying tolerance of less than 0.0005 inch.

Motor power is supplied by a 1/3-H.P. single-phase, alternating-current, 110- to 220-volt, 60-cycle motor having a speed of 1750 R.P.M. This machine requires a floor space of 8 by 2 feet and weighs about 800 pounds. 54

LeMaire Hollow Milling Machine

A hollow-mill designed especially for machining a round trunnion on each end of a turbine blade, and, at the same time, facing the blade to length, has just been brought out by the LeMaire Tool & Mfg. Co., Dearborn, Mich. An index table carrying four special toggle clamp fixtures occupies the center of the machine. Hollow-mills located on two sides of the work are operated by horizontal slides. Each slide carries two auxiliary slides on which the cutter-heads are mounted. The base of the machine houses the coolant fluid and the index mechanism. Power for moving the slides is furnished by hydraulic units mounted on each end of the machine.



Hollow Milling Machine for Machining Trunnions on Turbine Blades

After loading one piece in the fixture nearest to him, the operator pushes the cycle starting button, which turns the table 90 degrees to the left where the roughing operation is performed. The station directly opposite the operator is not required for this particular work. The fourth station, or the one to the right, completes the finishing operation. As the operator loads each piece, work proceeds on the pieces already in the fixtures at the right and left of this position.

As soon as the horizontal slides are in position, the cutter-heads advance rapidly toward the work,

To obtain additional information on equipment described on this page, see lower part of page 202.

feeding the hollow-mills inward. At the end of the milling cycle, the cutter-heads are retracted by a rapid return movement. When the cutters are in the back position, the horizontal slides move back to the end of the machine to complete their cycle. During the working cycle the operator unloads and reloads the front fixture and starts each cycle by actuating a push-button.

The auxiliary slides carrying the cutter-heads are pivoted and are equipped with protractor and vernier scales. This permits the heads to be so adjusted that the trunnions can be hollow-milled at any angle. The latter feature provides sufficient flexibility to permit the production of blades with trunnions that are straight with the axis on both ends, with one trunnion straight and the other at an angle, with a trunnion only at one end, or with two trunnions at any angle with the axis. By using convex-shaped cutters, it is possible to machine the blades to a concave shape around the trunnion. 55

H-P-M Fastraverse Forging Press

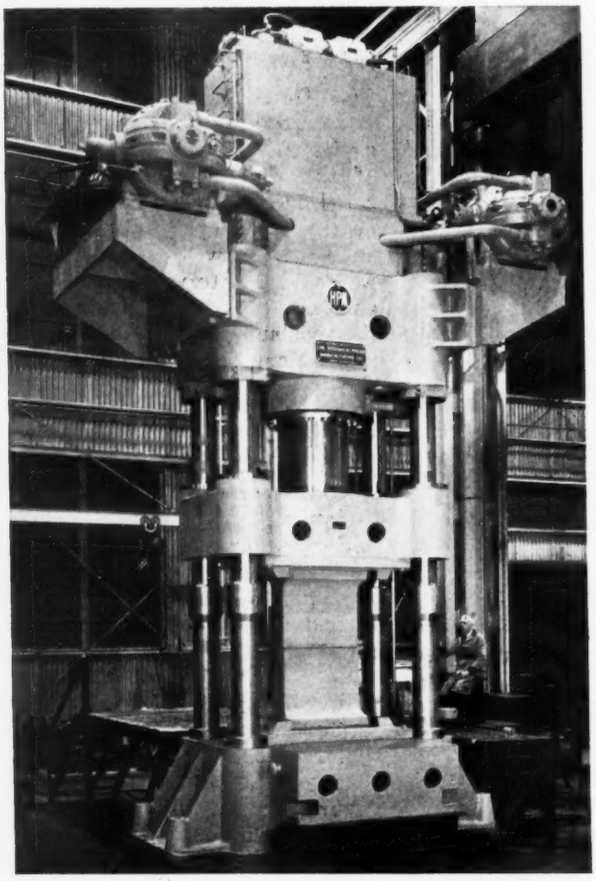
A new 1000-ton H-P-M Fastraverse self-contained, open type forging press built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, was recently demonstrated before a large group of members of the steel forging companies. The demonstration consisted of working down a hot steel billet, 15 by 15 by 84 inches in size, between the anvil blocks. This billet was forged into a spindle with a minimum diameter of approximately 11 inches. Several small billets, 12 by 12 by 8 1/2 inches long, were also forged into disks 18 inches in diameter by 4 inches thick.

This new press is a self-contained unit with motor-driven hydraulic pumps mounted directly on the press cylinder. The Fastraverse principle of operation is employed, which permits the operator to easily control the amount of pressure applied to the work.

The platen is 72 by 48 inches, and the bed 72 by 111 inches. The bolsters are 68 by 48 by 9 inches thick, and the die-blocks 36 by 12 by 30 inches high. The maximum daylight opening between the platen and bed is 108 inches, and between the die-blocks 30 inches. The maximum ram travel is 42 inches. The ram has a closing and opening speed of 560 inches per minute and a pressing speed of 105 inches per minute. Two motors are required, each of 200 H.P. with a speed of 720 R.P.M. The weight of this machine is 244,500 pounds. 56

Moore Precision Jig Grinder

The latest addition to the line of machine tools built by the Moore Special Tool Co., Inc., Bridgeport, Conn., and distributed by Marburg Brothers, Inc., 90 West St., New York City, is the precision jig



H-P-M 1000-ton Fastraverse Forging Press

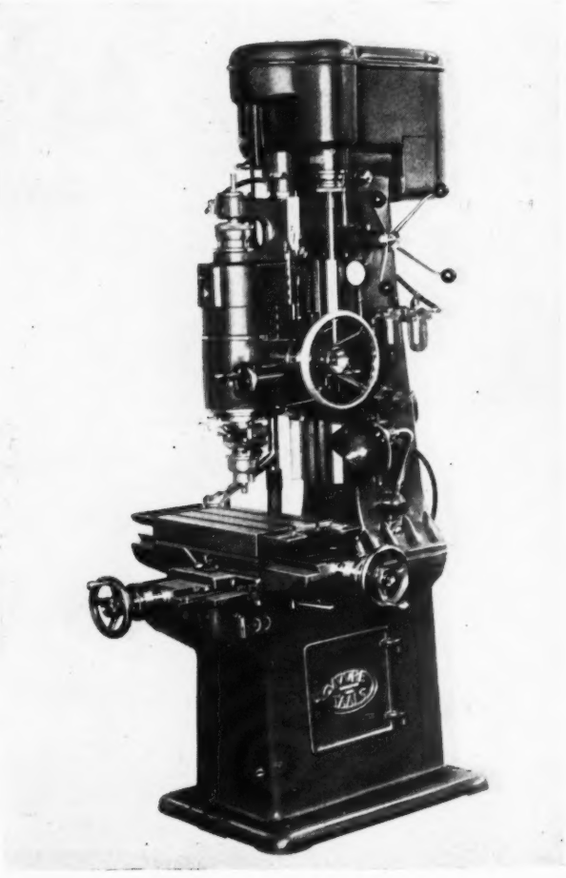


Fig. 1. Moore Precision Jig Grinder

To obtain additional information on equipment described on this page, see lower part of page 202.

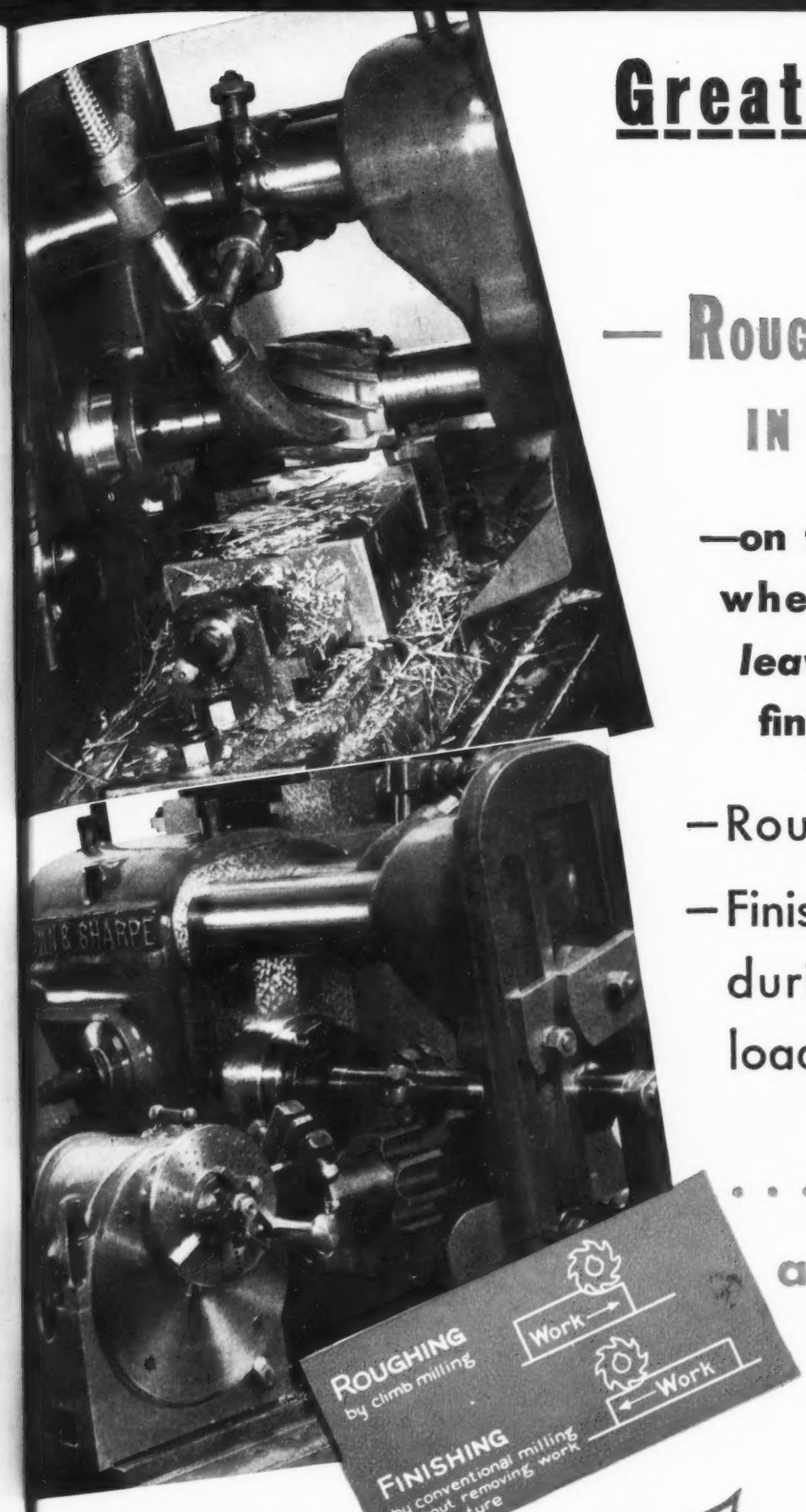
Greater Production from your No 12s!

— Rough and Finish Mill in ONE Setting

—on formed cuts *particularly* where the roughing cut *leaves* a slight amount for finishing

—Rough by **climb** milling

—Finish by **conventional** during return of table to loading position



. . . *All* in One fixture and One set-up

And for the finishing cut after automatic reverse in cutting feed, the dual feed rate on the No. 12 Plain Milling Machine frequently permits the option of changing from the forward feed rate, if desired, to **double** or **half** the initial rate.

KEEP MACHINES PRODUCING

- Keep them clean
- Lubricate regularly with proper oils
- Keep bearings and gibs adjusted

—A little consideration on your part will prevent unnecessary wear, breakdowns and repairs

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U.S.A.

Deliveries Are Good on New No 12's

BROWN & SHARPE

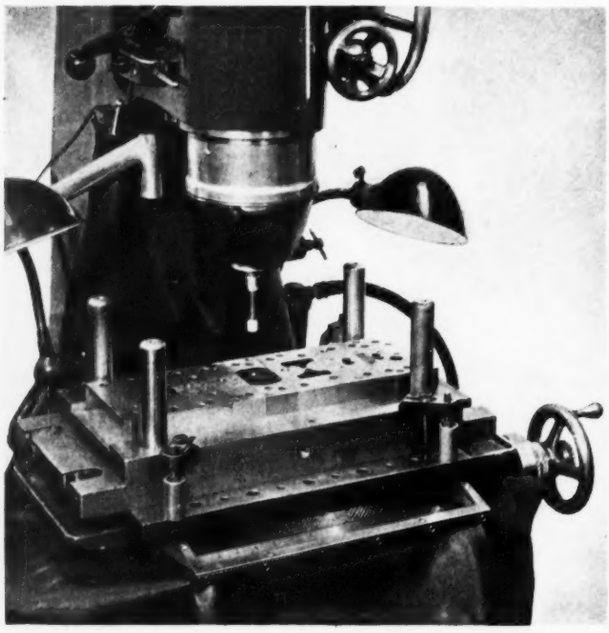
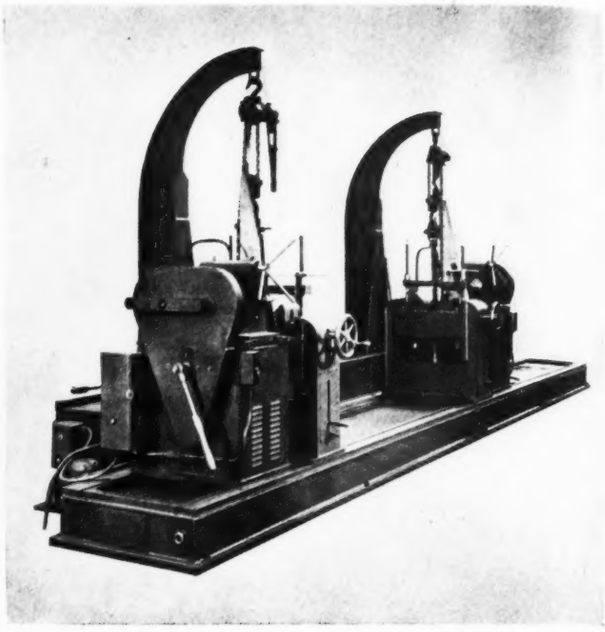


Fig. 2. Finish-grinding a Six-position Die on Moore Jig Grinder after Hardening



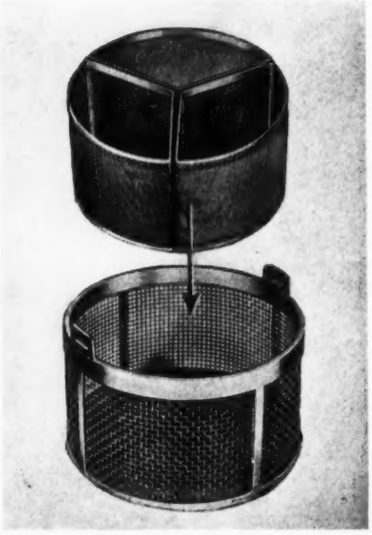
Centering Machine for Large Work, Brought out by the Kent-Owens Machine Co.

grinder shown in Fig. 1. This machine was developed for grinding holes to size and for correcting the location of holes in hardened parts.

The jig grinder will relocate holes and finish-grind them, straight or tapered, within limits of 0.0001 inch. Instead of grinding the holes in one section of the die at a time and going through all the steps of centralizing, locating, indicating, grinding, reassembling, and checking, the Moore jig grinder permits all these operations to be done in one setting, with the die completely assembled in its own die set and located on its own dowels, as shown in Fig. 2. 57

Triple Baskets for L & R Industrial Cleaning Machine

A triple basket has been devised for the industrial cleaning machine made by the L & R Mfg. Co., 54 Clinton St., Newark, N. J., which enables three different types of parts to be cleaned individually and yet be run through the machine at the same time. The work-basket, into which this new triple basket fits snugly, is 3 3/8 inches deep by 5 1/2 inches in diameter. The triple baskets are made of fine-mesh material, and will hold minute parts without danger of their slipping through the mesh. 58



L & R Triple Basket for Cleaning Three Different Types of Parts at One Time

Double-End Centering Machine for Large Work

A new machine for centering both ends of large work has just been placed on the market by the Kent-Owens Machine Co., Toledo, Ohio. The work is freely suspended in slings, and is easily and quickly adjusted into position by means of two davits, each equipped with a chain hoist. Suspending the work freely in this manner permits locating the centers in the approximate center of gravity of the piece instead of the geometric center. The machine handles work up to 14 inches in diameter and up to 19 feet in length. Simple modifications can be made, however, to accommodate larger work. The davits, work-supports, and centering machines are adjustable along the base to suit the job.

After the centers are located, the work is lowered into the V-blocks of the work-supports which are positioned by means of horizontal and vertical adjustments to align the scribed centers with the centering tools. The horizontal adjustment is obtained by means of a screw and handwheel, and the vertical adjustment by a hand-operated hydraulic jack. After being properly located, the work is clamped in position.

Each of the centering heads is provided with two spindles, one for the starting tool and the other for the final centering operation. The first tool on each head is fed into the work and withdrawn by means of the star handwheels. The heads are then moved laterally by the hand-lever, and properly indexed into position for the second tool by a simple spacing arrangement, after which the final centering tools are fed into the work in the same manner as the first tools.

To obtain additional information on equipment described on this page, see lower part of page 202.

In 1936, The Cincinnati Shaper Company adopted the "Winged Victory" figure as a symbol for victory in production through accuracy. Today, in our minds, its significance has infinitely widened.

SHAPERS

BRAKES

SHEARS

At the end of the road lies Victory.

. . . It's "all out" production in your shop.

. . . It's "all out" production in our shop.

Together, we speed the tools for Victory.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

Each head is provided with a separate motor-driven coolant pump and individual push-button control for the hydraulic drive. Separate coolant tanks are provided at each end of the welded base. 59

Cleveland Heavy-Duty Tapping Machine

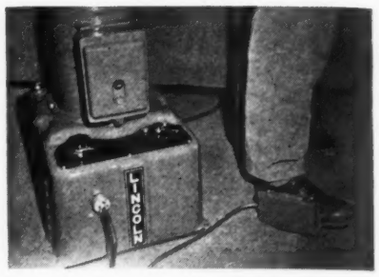
The Cleveland Tapping Machine Co., 1725 Superior Ave., Cleveland, Ohio, has added to its line a Model DB sixteen-speed, heavy-duty, lead-screw type tapping machine. This machine has a capacity for tapping 1 1/4-inch N.C. threads in steel. It has a dual push-button control for either automatic or manual operation.

A visible dial indicator provides means for accurately adjusting the reverse control, which is so sensitive that the vertical travel of the spindle can be held within limits of 0.005 inch. The controls are so synchronized that the rotation of the spindle is reversed within a maximum of a quarter turn of the spindle at the moment of reversal.

The speed change is obtained through a four-speed transmission and four-step V-belt pulleys. The final drive is through a four-groove sheave in which a sensitive clutch has been incorporated to protect the tap. The wide range of speeds —45 to 300 R.P.M.—makes this machine particularly adapted for shell work. It is equipped with a 3-H.P. motor, an oil-pump and tank, and has a No. 4MT spindle. The machine is shown in the illustration with the housing removed. 60

Lima Tool-Room Pedestal Grinder

A tool-room pedestal grinder made in 24S and 25S types, of 2 and 3 H.P., respectively, has just been added to the line manufactured by the Lima Electric Motor Co., Lima, Ohio. These machines operate at a spindle speed of 1800 R.P.M. on two- or three-phase alternating-current motors from circuits of 220, 440, or 550 volts. The machine accommodates grinding wheels 12 inches in diameter with face widths of 2 inches. The distance between wheels on the 24S grinder is 20 1/4 inches, and on the 25S grinder, 24 inches. The machines weigh 480 and 510 pounds, respectively. 61

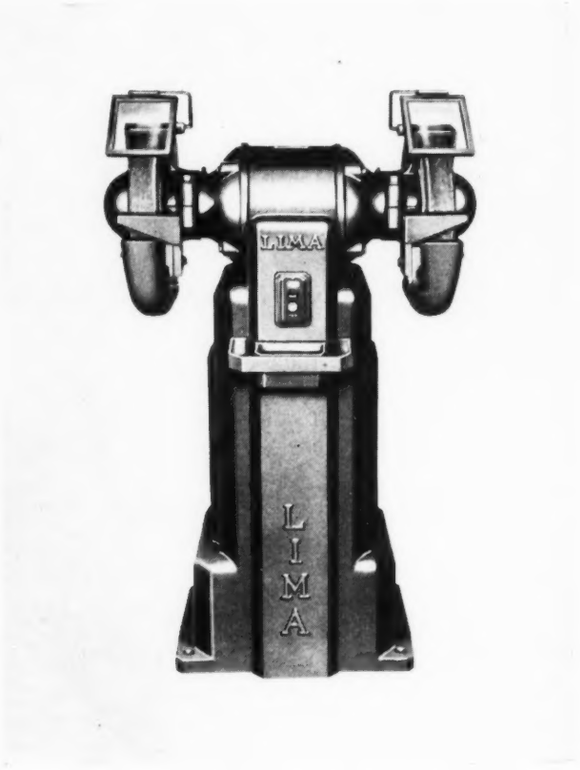


Lincoln Foot-operated Arc-welding Control

Lincoln Arc-Welding Control

A unique type of arc-welding control designed to enable the welder to speed up his work, and at the same time, perform it more accurately has been developed by the Lincoln Electric Co., Cleveland, Ohio. This control, called the "Lincontrol," is almost as light as a shoe, and when strapped to the welder's foot, enables him to move about with it freely, yet have instant control over the welding current. It is especially intended for aircraft welding, but is applicable for welding light-gage sheet metal of all kinds. With the control

Cleveland Heavy-duty Tapping Machine with Push-button Control



Tool-room Pedestal Grinder Made by the Lima Electric Motor Co.

To obtain additional information on equipment described on this page, see lower part of page 202.

THE SUPER SERVICE RADIAL

Here's a well-known Machine Tool, well-known for its rapid, low cost, high precision, quality work! The features of the Super Service Radial make this machine ideal for war-production plants where continued service for 24 hours a day, 7 days a week, is routine practice. The Super Service Radial is illustrated above, set up for line-reaming landing gear trusses, at one of the Douglas Aircraft plants. This job calls for extreme accuracy; two trusses are located in the jig by means of plugs inserted through reamed holes to maintain in-line accuracy of both parts. Consistently accurate performances of this nature are characteristic of the Super Service Radial.

List of features will be sent upon request.

ARMY E NAVY
AWARDED SEPT 10, 1942

SUPER CB SERVICE

THE CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO, U. S. A.

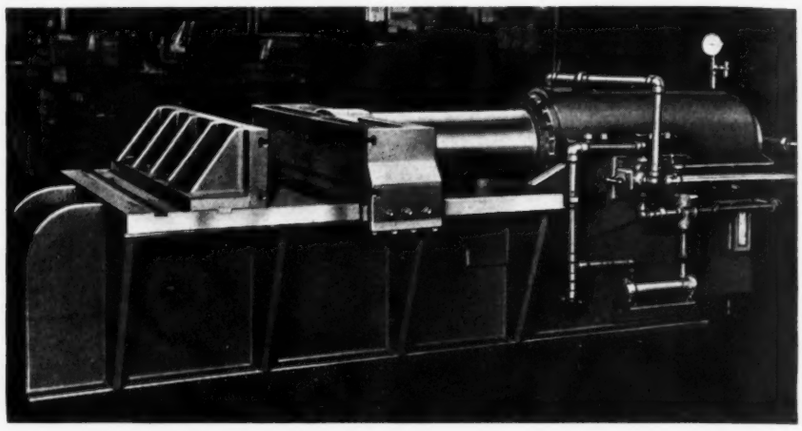
strapped to his foot, as shown in the illustration, the welding operator merely presses down on the pedal, causing the pin to operate a current control. The current is increased by exerting more foot pressure. 62

Combination Grinding and Buffing Machine

A combination grinding and buffing machine with exhaust equipment for removing and collecting grinding and buffing particles has been brought out by the Standard Electrical Tool Co., Department A, 2488 River Road, Cincinnati, Ohio. The machine is made in 1-, 2-, 3-, and 5-H.P. sizes.

At the left side of the machine is a hinged grinding wheel guard which is adjustable for wheel wear and is fitted with adjustable spark breaker and work-rest. The spindle is mounted in three heavy-duty ball bearings, and the buffer end is fully enclosed.

The dust-arrester assembly includes a material-handling fan, blower, air-filtering stand, and adjustable exhaust hood for the buffing wheel. The machine motor and fan motor operate simultaneously through the push-button starting equipment. The dust collecting system is available separately for application to any type of grinding, buffing, and polishing equipment, and is produced in three sizes. ..63



Beatty Hydraulic Bulldozer Built for the Heavy Metal-working Industries

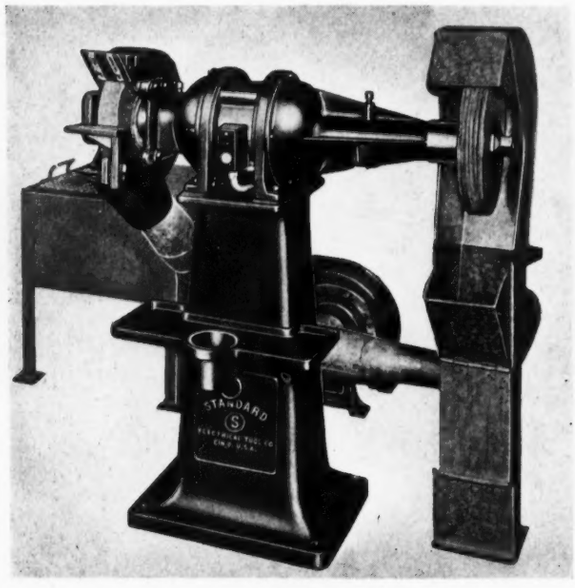
Beatty 200-Ton Bulldozer

A 200-ton hydraulic bulldozer has been built by the Beatty Machine & Mfg. Co., Hammond, Ind., which is adapted for a wide range of operations in the heavy metal-working industries. This machine has a stroke of 36 inches and a shut height which is adjustable to 14 or 24 inches. The maximum opening is 60 inches, the ram head is 12 by 60 inches, and the table is 60 inches long. This bulldozer has pressing and return speeds of 20 and 60 inches per minute. 64

DoAll Master Gage-Blocks

The Savage Tool Co., Department M, Savage, Minn., has just placed on the market a set of gage-blocks designated "Set 400," which consists of eighty-one blocks. The individual blocks range in length from 0.050 inch to 4 inches, and are produced in an AA grade, with an accuracy of 0.000002 inch, an A grade with an accuracy of 0.000004 inch, and a B grade with an accuracy of 0.000008 inch.

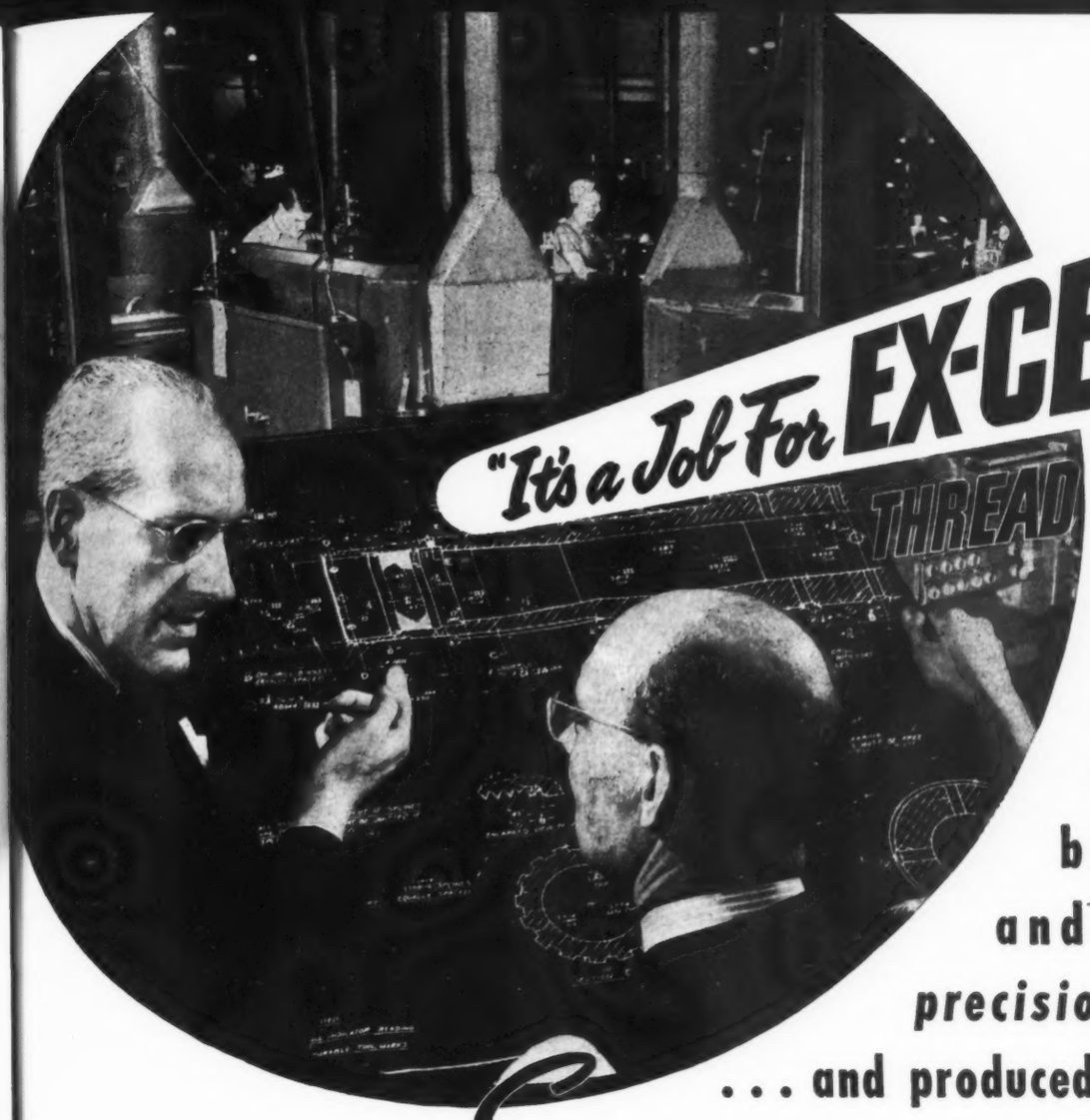
Each gage-block, in addition to being extremely accurate in length, has its measuring surface lapped to a flatness of less than a quarter



Grinding and Buffing Machine Brought out by Standard Electrical Tool Co.

Master Gage-blocks Brought out by the Savage Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 202.



"It's a Job For EX-CELL-O THREAD GRINDERS...

...these threaded parts must be hardened and ground to *precision* tolerances ...and produced plenty fast!"

SINCE EX-CELL-O introduced the original production thread grinding machine seven years ago the standard for threaded work has definitely risen. Closer tolerances are now demanded and maintained. The use of harder and heat-treated material in the making of threaded parts no longer presents difficulties. Numerous parts today have threads ground on them directly "from the solid" (often, where the pitch is a relatively fine one in a single pass).... For instance—*precision thread grinding* is the preferred method today among aircraft engine builders for finishing threads on parts such as crankshafts, engine cylinder barrels, crankshaft bearing and connecting rod bolts, tappet adjusting screws, various studs and many other threaded parts. With work pieces of ample threaded length, frequently one operator conveniently handles two or more EX-CELL-O thread grinding machines. ... *All of which means important savings in production time!*

EX-CELL-O CORPORATION • DETROIT

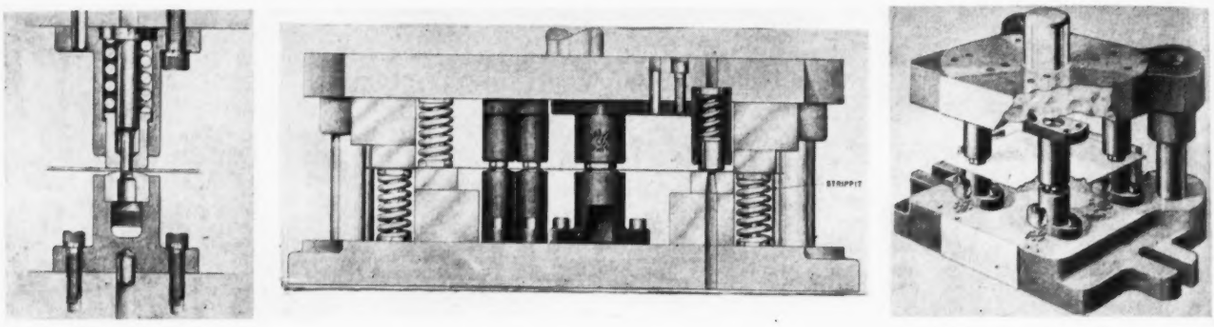
This EX-CELL-O book on Thread Systems, Forms, and Measurements contains much practical information for all those using Precision Thread Grinding Machines. A request for a free copy, on your business letterhead, will be given immediate attention. Address Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit, Mich.

...r each of the ... plants of Ex-...O in Detroit fly ... flags . . . the ...ond Stripes, as ...ys, the Army-... "E" pennant, ...he first United ...Treasury "Bull's-... War Bond flag.

...ecision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC ...WER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSH-...S • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

XLO

EX-CELL-O *means* PRECISION



(Center) Wales Punching Units. (Left) View through Unit, Showing Stripping Mechanism and Pilot-pin in Die-holder. (Right) Four Wales Units and Back Gages Mounted on Conventional Die Set

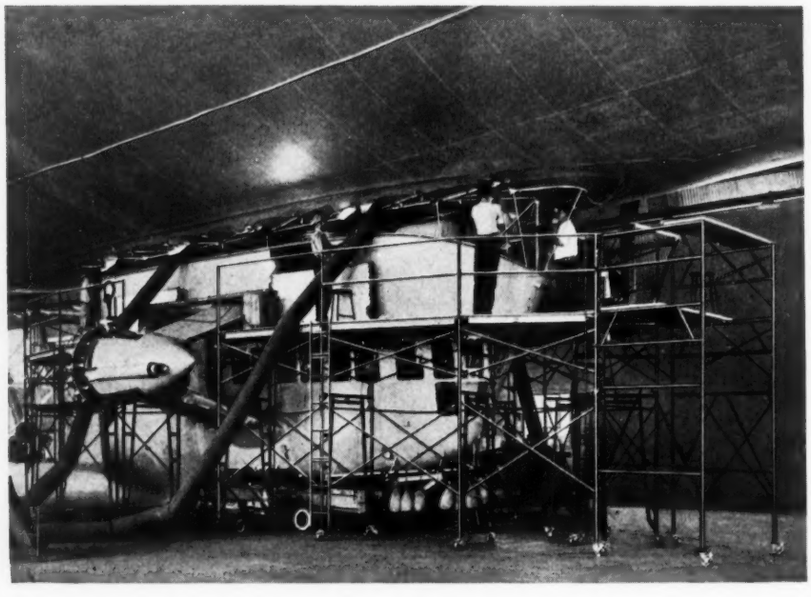
wave length of light, and is produced with a mirror finish. These two factors enable the blocks to be wrung together, so that the user can obtain any dimension from 0.1000 inch to 12 inches in steps of 0.0001 inch. The gage-blocks are supplied in a mahogany case. 65

Safway Steel Scaffolding for Assembly Work

Steel scaffolding equipment for use in assembling large machines, the basic unit of which consists of two end frames which are held rigidly together by two crosswise braces, has been developed by Safway Steel Products, Inc., 6228 W. State St., Milwaukee, Wis. The basic unit of this scaffolding forms a complete assembly 5 feet wide, 7 feet long, and 5 feet high. Any desired heights are obtained by adding similar assembled units through the use of coupling pins. Additional lengths are made by adding frames and fastening them together with cross-braces.

The steel scaffolding used for attaching the gondola to the bag of Goodyear blimps, as shown in the illustration, was designed by the Safway Co. in cooperation with the Goodyear Tire & Rubber Co. This scaffolding completely encircles the gondola, fits easily around corners or projections, and provides ample working space for the operators.

When the gondola is received, the scaffolding is rolled into the required position and locked in place by brakes on the casters. Assembly can begin at once, and when the work is completed, the scaffolding is simply rolled back. 66



Safway Steel Scaffolding Used for Attaching Gondola to Blimp

Wales Hole-Punching Unit

New Wales CD hole-punching units for use in conventional die sets have been announced by the Strippit Corporation, North Tonawanda, N. Y. The punch unit half of the equipment contains a punch with a pilot, a holder, a stripping spring, and a guide. The die unit half consists of a holder with a slug clearance chute and a die. Each unit is self-contained and independently mounted to either the punch- or die-shoe. This makes every punch- or die-holder quickly and easily accessible for changing individual punches and dies. A pilot-pin centered on the punch or die is built into each holder in order to assure accurate punch and die alignment.

There are two simple methods of mounting these units in a die set. The customary way is to mount the units directly on the punch- or die-shoe, and with a templet, mark the pattern of holes to be punched on one of the two shoes. Both shoes are then clamped together, and the holes for the pilot-pin are drilled through the shoes. The pilot-pins on each punch- and die-holder fit into the pilot-holes in the punch- and die-shoes, and are automatically aligned.

The other method consists of mounting the units on templets which slide into position and are bolted to the shoes. Alignment of the punch and die templet mountings is accomplished by a ring which fits over the die and the punch, thus aligning the punch and its corresponding die.

These units are employed in either punch presses or press brakes to punch holes 1/16 inch to 1 1/8 inches in diameter in metal up to 11 gage thickness. 67

To obtain additional information on equipment described on this page, see lower part of page 202.

SUNOCO EMULSIFYING CUTTING OIL

"helps machine manufacturer prolong tool life by 40%"

Bullet assembling machines are the wartime specialty of this machine tool manufacturer . . . and one factor that's contributing to their high production quota is Sunoco Emulsifying Cutting Oil.

Before changing to Sunoco, excessive heat made necessary low machine speeds. Production was limited . . . tool life poor. At the recommendation of a Sun Doctor of Industry—a metal working expert—the change in cutting oil was made. Improvement was immediate. Tool life increased 40%. Sunoco's exceptional heat absorbing qualities permitted high speeds . . . production was increased 40% and the finish of parts was noticeably better.

This is one example among many where Sunoco Emulsifying Cutting Oil is helping American industry turn out a flood of better war materials—faster. Call in a Sun Oil Company Engineer. Let him show you the value of Sunoco as an aid to increased production in your own plant. He stands ready . . . willing . . . and able to serve you.

For case histories of how he has helped others, write for your copy of "Helping Industry Help America."

SUN OIL COMPANY • ***Philadelphia***

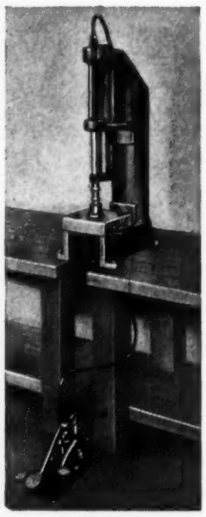
Sun Oil Company, Ltd., Canada

SUNOCO

SUN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AMERICA*

Studebaker Speedpress

A hydraulic arbor press capable of developing pressures of 20,000 pounds, known as the "Speedpress," has just been brought out by the Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill. This press is entirely foot-controlled, leaving the operator's hands free to handle the work. Pressures from 0 to 20,000 pounds are obtained by operating the pedal of the hydraulic control, which can be placed in any convenient position and connected with the press by a steel tube.



Foot - controlled Hydraulic Arbor Press

One movement of the applicator pedal causes the ram to move downward into contact with the work. Another foot pressure on the booster pedal applies any holding or gripping pressure desired. A release pedal breaks the pressure, and the ram automatically returns to the top of its travel. This release is accomplished in less than a second. All kinds of "Speedpress" work, such as broaching, assembling, piercing, oil-grooving, riveting, sizing, trying out small dies, and forming and pressing operations, can be handled by this new equipment. It will accommodate work 15 3/4 inches in diameter. The largest arbor or size of opening in the base for an arbor is 6 inches. The capacity over the table plate is 11 7/8 inches, and the ram stroke 7 inches. The shipping weight of the press, including the platen and foot control, is 303 pounds. 68

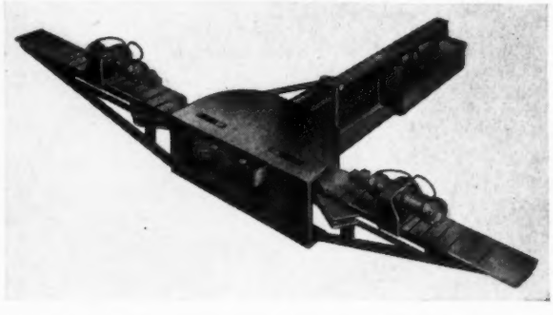
Hufford Hydraulic Bending and Beveling Machine

A bending and beveling machine designed especially for handling extruded rolled and flat strips of all shapes and in a wide variety of materials has been brought out by the Hufford Machine Works, Inc., 315 Diamond St., Redondo Beach, Calif. This machine operates on an entirely new principle of metal forming by placing the work-piece under heavy tension, and at the same time, bending it around a forming block or die.

The stationary table carries the forming die and two simultaneously actuated arms which are hydraulically operated and hinged to the table. The pivotal positions of the arms can be moved to accommodate work-pieces of various radii. Each arm carries an additional hydraulic cylinder which is adjustable to accommodate various lengths, and is equipped with suitable adapters and grippers for holding the work.

The forming dies can be quickly made of hard wood to approximately the required shape, tested, and corrected for spring-back, and then faced by ordinary steel plate or aluminum alloy. Bending and beveling are accomplished in a single operation. During this operation, the material can be twisted around on its own normal axis or its cross-section can be modified by changing the angular relation between its sections.

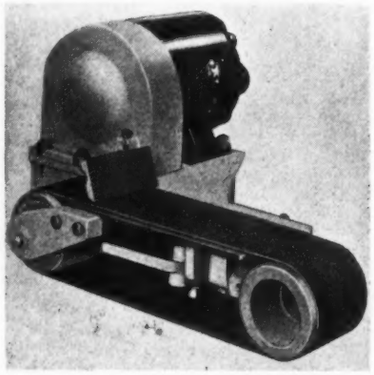
This machine has a capacity for work ranging from 12 to 200 inches long. It will handle work 7 by 7 inches, with a maximum cross-sectional area of approximately 3 square inches. The die widths range from 6 to 120 inches. The machine is driven by a 10-H.P., 220- or 440-volt, three-phase motor. Its hydraulic system operates at a pressure of 2000 pounds. The machine weighs 12,000 pounds. 69



Hydraulic Bending and Beveling Machine Made by Hufford Machine Works, Inc.

Walls Abrasive Band Grinder

A bench type abrasive band grinder has recently been introduced on the market by the Walls Sales Corporation, 96 Warren St., New York City. This grinder, designated the Standard D-4, has a 1/3-H.P. protective-hood motor with a fully enclosed V-belt drive.



Abrasive Band Grinder Brought out by Walls Sales Corporation

It is ball-bearing equipped, and has an Alemite lubricating system. The abrasive band is 4 by 36 1/4 inches, and the table is 4 1/2 by 9 inches. 70

"Stanicut" Cutting Oils

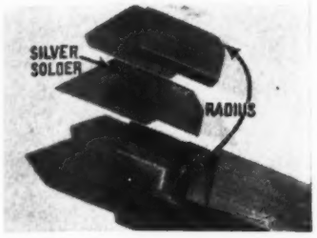
To help solve some of the problems imposed on metal-cutting plants by the demands for close tolerances and high finishes on new metals machined at high speed, the Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill., has added to its line of cutting oils a new line known as "Stanicut." The new oils consist of five grades varying in viscosity, as well as in types and compounding characteristics.

Stanicut 62-FC is a low-viscosity oil recommended for use in machining tough aluminum

To obtain additional information on equipment described on this page, see lower part of page 202.

HOW TO TORCH-BRAZE CARBIDE TIPS TO SHANKS AND GET TOOLS ON THE JOB FAST

To get carbide tools on the job fast, many plants maintain an active stock of standard Carboloy Cemented Carbide tips—ready for brazing to shanks. In this way, carbide tools can be made available for most jobs within an hour after the need arises. Saves weeks—often months—of time—particularly on non-standard, made-to-order type of carbide tools. For this work you need simply an oxy-acetylene torch, and a few brazing accessories including flux, silver solder sheet or rod, etc. Procedure is simple, fast and efficient. Technique quickly acquired, even by inexperienced personnel. Carboloy Training Film available at $3.50 for fast instruction.



← After milling and grinding shank angles, mill recess in shank to fit carbide tips. Cut silver solder sheet (.003 thick) slightly larger than recess. Clean tip, sheet and recess with carbon tetrachloride.

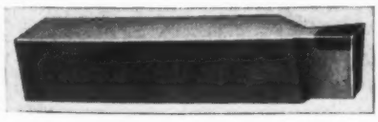
Place shank in vise as shown. Apply flux liberally → to shank recess and well back of recess. Flux silver solder sheet; place in recess. Flux carbide tip; place in recess. Assembly now ready for brazing.

Large Standard Tools in Stock for Heavy Work

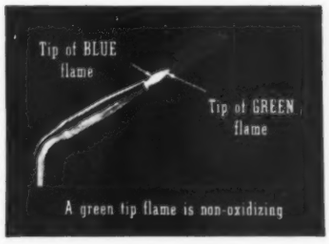
A range of large size standard tools suitable for heavy cast iron and steel cutting work on boring mills, lathes, etc., are now in stock (1-13-43) available for immediate deliveries. In standard styles Nos. 4 and 7 (right and left hand straight turning) and Nos. 13 and 14 (15° side cutting-edge angle, left and right hand turning). Sizes 1½" square and 1½" x 2". Grade 44A for cast iron; 78B for steel.

Standard-Design Carboloy Tools for Cutting Off to Hollow Cores

Following an analysis of thousands of cut-off tools ordered in the past, standardized



designs have been established for tools of this type. These cut-off tools are easy to order, speed up deliveries and eliminate special drawings. Standard-design Carboloy cut-off tools are designed for cutting off to hollow cores, such as on shell forgings, etc. Write for catalog GT-142.



← Adjust oxy-acetylene torch to 10 lbs. pressure on both gages, with a tip of green flame and blue flame as shown.

Apply torch along → bottom. Keep moving. Then work around sides and end of shank. Avoid excessive, or spotty, heating.

← When solder melts and shank and tip become dull cherry red, direct flame on the tip.

Then take a holding rod and move tip back and forth → to wipe in joint and distribute silver solder evenly.

← Now remove flame and press down squarely on tip. Heavy pressure not needed. Hold until silver solder sets.

Set tool aside and → allow to cool naturally. *Do not quench* in liquids as tip may crack.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11147 E. 8 MILE AVE., DETROIT, MICH.

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia

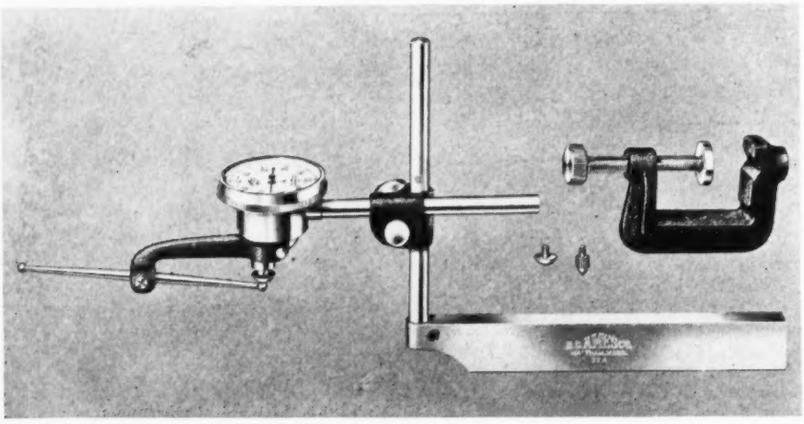
Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY CEMENTED CARBIDES

TOOLS • DIES • DRESSERS
CORE BITS • MASONRY DRILLS
• WEAR RESISTANT PARTS •

FOR THE MANUFACTURING • MINING • TRANSPORTATION • CONSTRUCTION INDUSTRIES



Universal Test Indicator Placed on the Market by B. C. Ames Co.

alloys and some bronzes. Stanicut 107-BC is designed for use in high-speed machining operations on free-cutting stocks where the requirements are not severe and a low oil cost is a prime factor. It is also suitable for machining copper and brass.

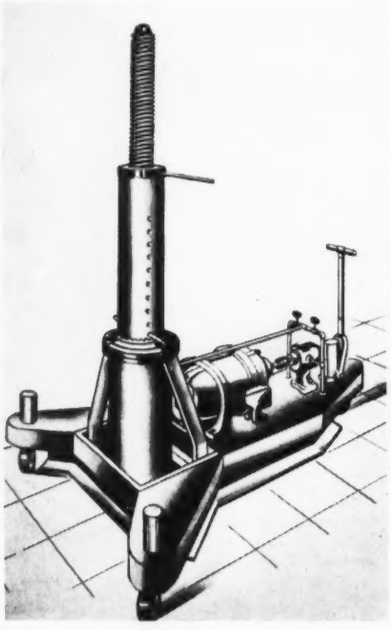
The oil designated as Stanicut 126-BCS is also recommended for high-speed machining operations, particularly on steel of a lower machinability rating than the free-cutting screw stocks. Stanicut 155-CS has been found to give excellent results in machining the tougher alloys of the S A E 3000 and 4000 series, particularly those that tend to smear and have a poor finish when ordinary cutting oils are used. Another oil, designated Stanicut 309-BCS, is intended especially for heavy broaching, threading, and tapping of soft steels or steels that tear easily. 71

Portable Hydraulic Airplane Lift

A portable electric-hydraulic lift, built for raising airplanes to free their landing wheels from the ground, has been brought out by the Globe Hoist Co., 1000 E. Mermaid Lane, Philadelphia, Pa. This lift was developed particularly for inspection and maintenance operations in airports and hangars, and will handle a wide range of planes.

From a "down" position of 50 inches, the lift provides a power rise of 27 5/8 inches plus a hand adjustment rise of 33 3/4 inches, or a total lift height of 111 3/8 inches. The top of the plunger is equipped with a heavy ball socket to contact the wing jacking pads of the plane, or it can be placed underneath the tail or nose section. The extended plunger can be locked at different heights by inserting a steel safety bar through holes spaced 3 inches apart. The hand-adjusted screw-jack portion of the plunger can also be locked at any height.

The power cylinder is operated by means of a 5-H.P., 220-volt, three-phase, sixty-cycle explosion-proof motor, directly connected to a geared pump having a capacity of 15 gallons per minute. Oil displacement of the power cylinder is 7 gallons. The maximum lifting capacity is 21,000 pounds, and the sustaining load capacity, 63,000 pounds. 72



Globe Portable Hydraulic Airplane Lift

Ames Universal Test Indicator

A small compact universal test indicator (No. 22-A), which can be easily set up and adjusted, has just been placed on the market by the B. C. Ames Co., Waltham, Mass. This indicator can be used on numerous testing jobs, and with the hole attachment, can be employed to reach internal surfaces and places that are not easily accessible.

The complete set includes all equipment shown in the illustration, which comprises an indicator No. 101-H, three contact points of different lengths, indicator holding rod, hole attachment, toolpost holder, upright spindle, sliding swivel, C-clamp, and box. 73

Coolant and Circulating Pumps

A number of new coolant and circulating pumps have just been brought out by the Ingersoll-Rand Co., 11 Broadway, New York City. This new line includes 3/4-inch and 1-inch side-wall mounted types, a 1 1/4-inch side-wall mounted type for low submergence applications, and a 1 1/4-inch horizontal type. These pumps are especially suited for installation on machines such as lathes, drills, automatics,

Ingersoll-Rand Side-wall Type Coolant Pump

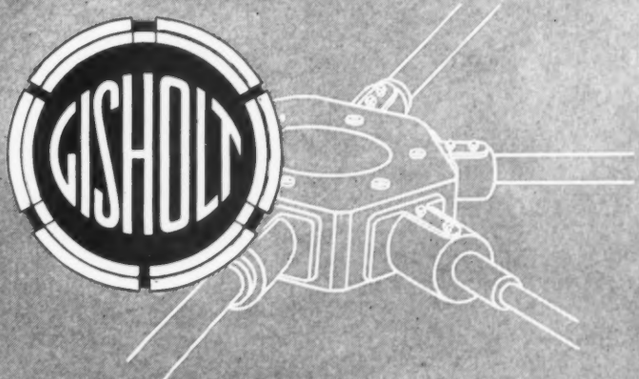
To obtain additional information on equipment described on this page, see lower part of page 202.

Make it fit to fight!

The American idea of mass production has created a world of interchangeable parts, one dependent upon the other. Wherever it is made—in your plant or in that of a subcontractor, the essence is accuracy. Machine tools like Gisholt Turret Lathes make this possible—assure the precision that makes parts fit to fight. Their proper use is vital to America—and to you.

GISHOLT MACHINE COMPANY · MADISON, WISCONSIN

Look Ahead — Keep Ahead — With Gisholt Improvements in Metal Turning

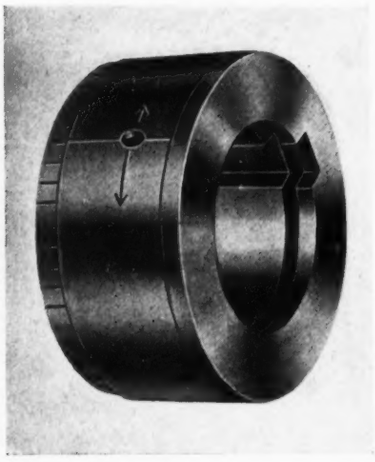


TURRET LATHES ★ AUTOMATIC LATHES ★ BALANCING MACHINES

cutting-off machines, and grinders that require a constant supply of cooling fluid or cutting oil. They are also suitable for use with evaporating condensers, air-conditioning units, washing machines, etc. 74

Adjustable Spacing Collars for Milling-Machine Arbors

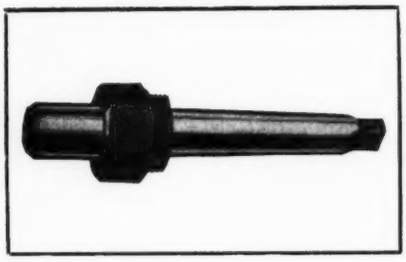
A heavy-duty adjustable spacing collar for milling-machine cutter-arbors, with hardened and ground backing plate, has been placed on the market by the Dayton Rogers Mfg. Co., 2835 Twelfth Ave., S., Minneapolis, Minn. This new collar is designed to withstand severe tightening of the milling-machine arbor nut, as required for heavy production work. It has an engraved indicator that shows in which direction the necessary adjustment must be made. The collar is now available for all standard milling-machine arbors. The maximum over-all adjustment provided in these collars is 1/8 inch, in increments of 0.0005 inch.....75



Dayton Rogers Adjustable Spacing Collar for Milling-machine Arbors

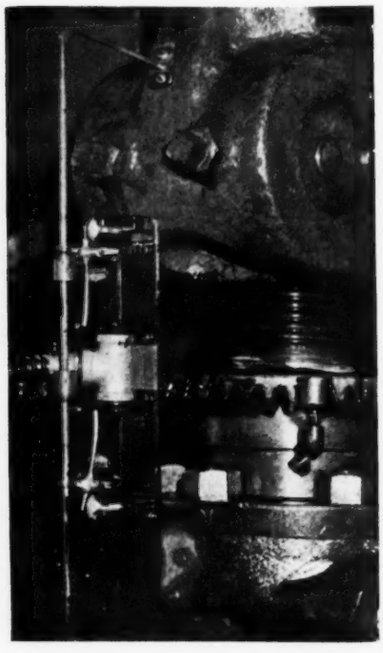
Erickson Precision Collet Chuck

A precision collet chuck designed for use on drill presses, lathes, milling machines, screw machines, portable electric and air drills, etc., has been brought out by the Erickson Steel Co., 2309 Hamilton Ave., Cleveland, Ohio. This chuck has a collet which is open-slotted at both ends, thus allowing the collet to collapse equally or uniformly throughout its length, and at the same time, maintain accuracy, as well as gripping power. It is designed to hold the drill or tool in a vise-like grip and continue to maintain its accuracy.



Precision Collet Chuck Made by Erickson Steel Co.

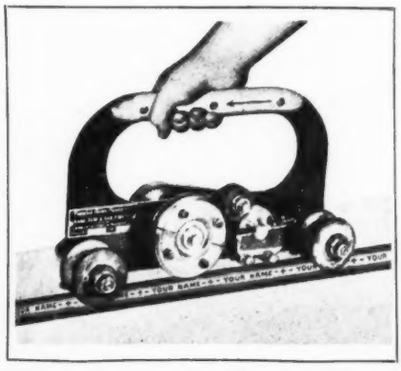
Shanks are available for spindles of either the external or internal type. The patented construction eliminates practically all twist and distortion of the collet. Speed in aligning work and accessibility to the job are features that tend to reduce labor costs and prevent spoiled work. This collet is capable of collapsing 1/32 inch, while maintaining accuracy and gripping power. The construction of the shank facilitates its application to any type of machine or set-up.....76



Westinghouse Limit Switches Applied to Press to Prevent Damage to Pitman Screw

York Tube and Bar Printing Machine

The Pannier Bros. Stamp Co.'s tube and bar printing machine, developed to provide a convenient and practical means of identifying products, marking grades and types of tube and bar stock, and similar work, is being manufactured for the trade by the York Electric & Machine Co., York, Pa. The machine is self-inking and easy to operate. The ink is properly distributed by a built-in fountain and distributor roller. Rubber type, with any identification or information available for the hand printer, can be employed.



York Electric Pannier Hand-operated Tube and Bar Printing Machine

The printing machine can be easily cleaned. Adjustable, interchangeable rollers are provided for using the marking machine on bars and tubes of various sizes.....77

Limit Switches Designed to Protect Punch-Press Screws

Damage to pitman screws on a large punch press equipped with a motor drive for raising and lowering the ram is eliminated in the Mansfield, Ohio, plant of the Westinghouse Electric & Mfg. Co., by the use of limit switches. These switches prevent the die-setter from jamming the pitman screws or running them out too far, which might cause the screws to bend under heavy loads. The switches are used only when changing the ram adjustment to suit the various dies. The accompanying illustration shows the limit switches connected in the electrical circuit of

To obtain additional information on equipment described on this page, see lower part of page 202.

PREVIOUS EXPERIENCE NOT NECESSARY

GISHOLT SIMPLIMATIC LATHES require very little operator training. All functions of this machine are entirely automatic. The operator merely loads and removes the work.

Such simple, automatic operation makes it possible for one man (or woman) to tend two or more Simplimatics. With multiple cutting and its swift cycle of operations, the Simplimatic produces continuously, accurately—at a brisk pace that no skilled machinist could ever equal.

GISHOLT MACHINE COMPANY • East Washington Avenue, Madison, Wisconsin

LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

GISHOLT

the adjusting motor. They are operated by stops mounted on a rod which is fastened to the connector pitman. 78

Atlas Coolant Pumps

Two compact, portable coolant pumps are being placed on the market by the Atlas Press Co., 153 N. Pitcher St., Kalamazoo, Mich. These units, which can be easily attached to almost any machine tool, are designed to meet peak production demands, reduce tool wear, and improve work finishes.

They are made in capacities to meet the maximum requirements of most makes of lathes, drill presses, millers, grinding machines, cut-off saws, screw machines, and single- and multiple-spindle drilling and tapping machines. No priming is necessary, and the complete coolant system can be assembled by selecting the proper feed and return units. 79

Locking System for Threaded Inserts and Studs

A new locking system developed by Jose Rosan to prevent studs and threaded parts from loosening is being manufactured under license by Bardwell & McAlister, Inc., Hollywood, Calif., for war industries only. The locking ring employed by this system has serrations inside and out, as indicated in Fig. 1. In practice, the stud is installed by the usual methods, and the serrated ring forced into place over interlocking serrations in the stud head, making a tight fit flush with the surface of the material in which it is used. Inserts can also be locked in place by means of the serrated ring.

While this locking system has been applied primarily to non-ferrous materials, it can be adapted to any material for which ordinary studs and inserts are used. Its effectiveness has been proved by testing on materials such as plywoods, solid wood, phenolic plastics, and aluminum and magnesium alloys.

In a series of tension tests, the insert has proved stronger than the bolt that was screwed into it when installed in magnesium alloy and aluminum alloy. With respect to torsion, the insert has proved more efficient than the bolt because of the great number of teeth in the outer periphery of the locking ring, which broach their way into the surrounding metal.

This means of locking the stud or insert in place can be adapted also to other applications.

One form has been developed as a hydraulic or gas seal, while another is employed as a spark-plug insert. When it is necessary to hold the positions of tapped holes to close limits, a solid type insert is used which can be drilled and tapped in assembling.

One type of insert (shown at *A*, Fig. 2) can be used as a drill bushing or it can be used as an adapter for a drill bushing. These bushings will not turn when in position, and thus insure permanence and accuracy. An insert such as shown at *B*, Fig. 2, can be installed in place of a stud which has pulled out or stripped its threads, and a cap-screw or similar stud can then be used. Special tools are not needed to install the insert. A bolt, a lock-nut, and a hammer are the only mechanical aids required. However, a threaded tool and lock-nut for installing the insert, and a driving tool with which to force the ring in place, have been made available. Thus, the installation operations can be performed either manually or by power. 80

* * *

During recent years there has developed a tendency to include in our revenue statutes special sections intended to bring about social reforms or business reforms, or to accomplish purposes other than the collection of revenue. As a result, our revenue acts are now more than revenue statutes and, as so often happens, the attempt to kill two birds with one stone kills neither. When we attempt to bring about social reform through revenue acts, we create uncertainty as to the constitutionality of the law, and we frequently fail to accomplish either objective of the tax law.—*Walter A. Cooper* in "A Sound Basis for Taxation"

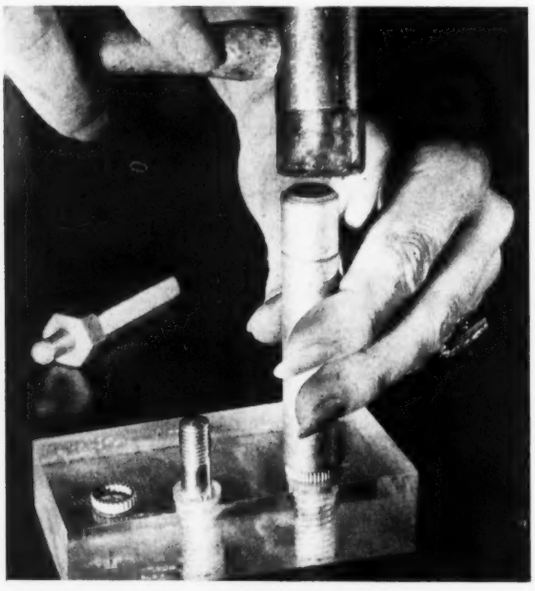


Fig. 1. (Left) Method of Installing Rosan Studs and Inserts in Plexiglas

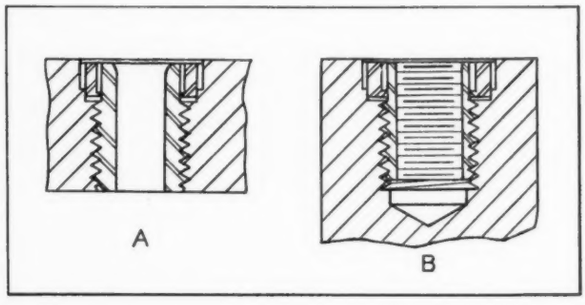
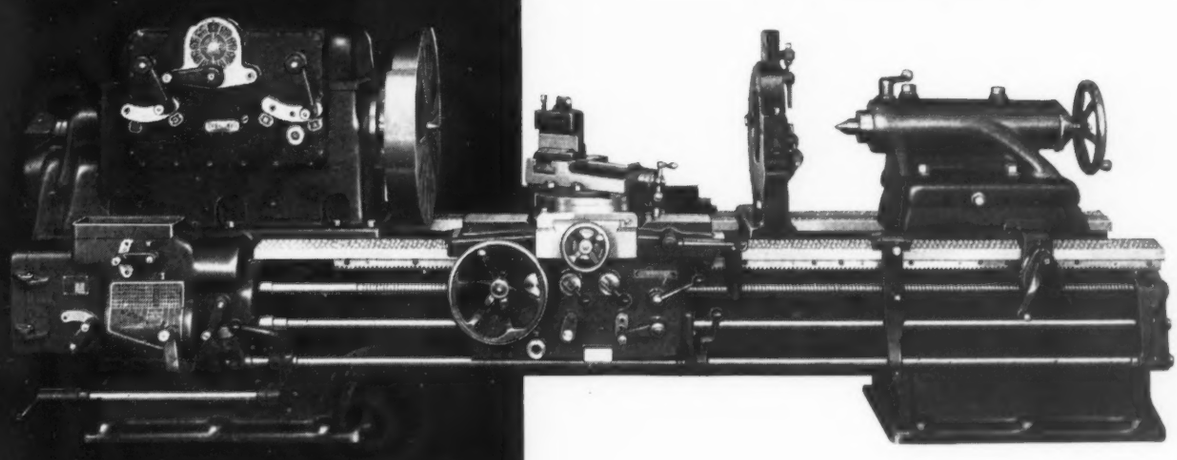


Fig. 2. (Above) (A) Application of Drill Bushing Type of Rosan Insert with Locking Device. (B) Stud Type Insert in Blind Boss

To obtain additional information on equipment described on this page, see lower part of page 202.

SIDNEY 30" 36" LATHE



SIDNEY
THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U. S. A.

FEATURES

Center bearing on spindle and intermediate shaft.

48 changes of threads from ¾ to 46 per inch.

48 changes of feeds from .003" to .207" per revolution of spindle.

Force feed lubrication to headstock—apron mechanism—carriage and bottom slide.

Twin-disc driving clutch and brake.

Double Wall Apron with anti-friction bearings and force feed lubrication.

16 Speed HERRINGBONE GEARED HEAD

This exclusive headstock design provides sixteen selective spindle speed changes with continuous tooth herringbone gears that are in constant mesh. Various speeds are obtained by engagement of sliding clutches operating on multiple spline shafts. Spindle is made of alloy steel forging, heat-treated and mounted on Timken Precision Bearings which take both radial and thrust loads and insures a true running spindle under most severe demands.

The SIDNEY MACHINE TOOL Company

SIDNEY U.S.A. OHIO

Half-Millionth Copy of MACHINERY'S HANDBOOK

On January 11 the half-millionth copy of MACHINERY'S HANDBOOK was sent out to the "industrial firing line." An order for this particular copy was received from W. Earl Miller, a draftsman with the Cameron Pump Division of Ingersoll-Rand Co., Phillipsburg, N. J. The HANDBOOK, which was delivered to Mr. Miller with the compliments of The Industrial Press, has stamped on the cover the inscription "Half-Millionth Copy."

W. Earl Miller, Who Received the Half-Millionth Copy of "Machinery's Handbook"

Every year a vast army of engineers, designers, mechanics, and engineering students, both in the United States and throughout the British Empire, obtain this well known work of reference. The total sales for 1942 were 103,218 copies. About 24 per cent of this total was sent to England. In fact, practically every British ship leaving the port of New York and bound for England carries from ten to twenty large cases filled mostly with copies of MACHINERY'S HANDBOOK. This enormous demand, both here and abroad, is not only a great tribute to the HANDBOOK, but also a forceful reminder of the responsibility involved in editing and publishing a book that is used daily as a work of reference in the mechanical industries of the world.

Reclaiming Precision Gage-Blocks

A controllable chromium-plating process has been developed at the Lynn River Works of the General Electric Co. for reclaiming precision gage-blocks that have become worn to such an extent that they no longer meet the accuracy requirements. The method by which the old blocks are built up is claimed to give them five times the service they possessed when new.

The three-step reclaiming process is performed by women. First, the blocks are lapped 0.0002 inch under size; then an even coating of chromium plating 0.00015 to 0.0002 inch thick is applied to each of two working surfaces, making the blocks from 0.0001 to 0.0002 inch over size. In the third step, the blocks are lapped to size.

The blocks are next checked for size and parallelism on a Pratt & Whitney General Electric Electrolimit gage, and for flatness on an optical flat. The maximum limit over or under the required size is five millionths inch. The blocks are checked periodically with a master set.

* * *

The United States Maritime Commission has given the "M" Award of Merit to the following companies: The Superior Engine Division of the National Supply Co., Springfield, Ohio; the Cooper-Bessemer Corporation, Mount Vernon, Ohio, and Grove City, Pa.; the Davis Engineering Co., Elizabeth, N. J.; and the American Locomotive Co., Dunkirk, N. Y.

Fig. 1. Lapping Precision Gage-blocks to Size in Reclaiming Process Developed by Lynn River Works of General Electric Co.

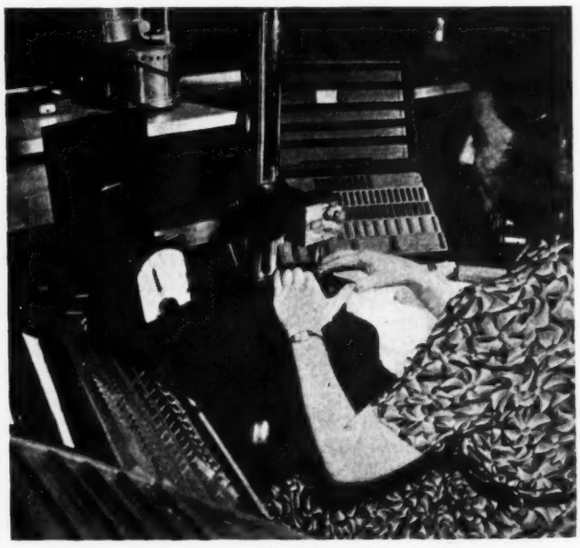
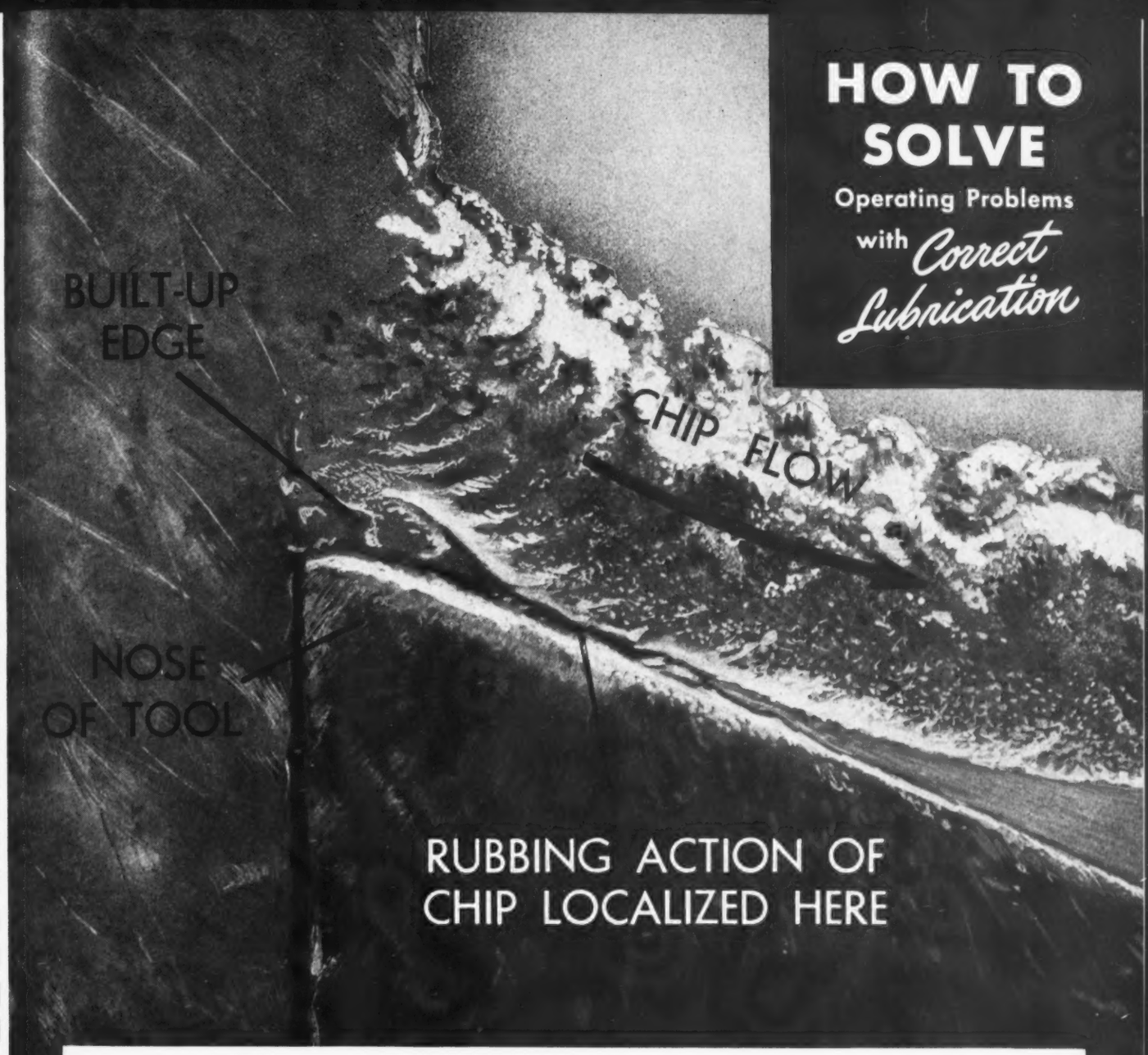


Fig. 2. Checking Reclaimed and Working Sets of Gage-blocks by Means of a Master Set of Precision Blocks

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION



HOW TO SOLVE
Operating Problems with *Correct Lubrication*

New Facts on Metal Cutting

THE PICTURE ABOVE is a photographic enlargement of the cross-section of a tool cutting metal. NOTICE THE BUILT-UP EDGE. That small piece of metal alternately builds up and sloughs off. It is the key to tool life and work finish.

The built-up edge, during its existence on the cutting edge, exerts the pressure which does the actual cutting or shearing of the metal.

Sufficient build-up protects the cutting edge by localizing the rubbing action of the chip some distance from the cutting edge.

Excessive build-up is squeezed between the tool and the work and spoils the finish. *Adequate mobility* prevents this, and enables the built-up edge to slough off with the chip.

The "anti-weld" property of the cutting fluid controls the size and mobility of the built-up edge!

In the laboratory and in practice Socony-Vacuum technicians have isolated and studied many other factors necessary in a cutting fluid.

THIS IS NEW, IMPORTANT INFORMATION. It may be able to vitally improve your rate of production!

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

Change in Composition of NE Steels

Modifications in the National Emergency steel compositions made necessary by unexpectedly greater amounts of nickel content in the scrap now available were approved on December 17, 1942, by representatives of the War Production Board, the Technical Committee on Alloy Steel of the American Iron and Steel Institute, and by representatives of the Iron and Steel Division of the Society of Automotive Engineers.

Because of the steadily increasing nickel content of scrap, many steel mills have found it virtually impossible to hold the nickel content of some of the NE steels below the 0.60 per cent originally specified. Sufficient carbon-steel scrap of low phosphorus and sulphur content has not been available to dilute the high-nickel scrap, and it is commercially impracticable to reclaim the nickel for any other use or in any other manner.

This condition prevented production in many mills of the NE 9400 series steels, which have a specification limit of 0.20 to 0.40 per cent nickel, and resulted in "off-analysis" heats in the 8600 and 8700 series. Last-minute switches of heats already in process to steels of higher specified nickel content had to be made in many instances, thereby complicating manufacturing procedures and delivery problems. The use of greater quantities of virgin nickel and sometimes of other elements, such as chromium or molybdenum, has also resulted.

To alleviate this situation and to make more efficient use of the alloying elements derived from scrap, revisions in the list of National Emergency steels have been made. The following compositions have been deleted: NE 8022; NE 8339; NE 8949; NE 8715; NE 8722; NE 8735; NE 8739; NE 8740; NE 8744; NE 8749. In requesting deletion of the NE 8700 series, the War Production Board is attempting to conserve molybdenum and to make possible more flexible use of scrap in the steel mills.

The NE 8600 series has been extended to compensate for the deletion of the NE 8700 series by the addition of the following compositions: NE 8635; NE 8637; NE 8640; NE 8642; NE 8645; NE 8650. The manganese content of these steels is 0.75 to 1 per cent.

The nickel content of all NE 8600 series steels has been changed to 0.40-0.70 per cent, an increase of ten points in the upper limit. The nickel content of NE 8720, the only remaining 8700 series steel, has been changed to 0.40-0.70 per cent —likewise an increase of ten points in the upper limit.

In the same manner, the nickel content of the NE 9400 series steels has been changed to 0.20-0.50 per cent, and the NE 9500 series has been changed to 0.40-0.70 per cent nickel—in both cases, an increase of 0.10 per cent in the upper limit.

* * *

Safety Device for Fingers of Turret Lathe Operators

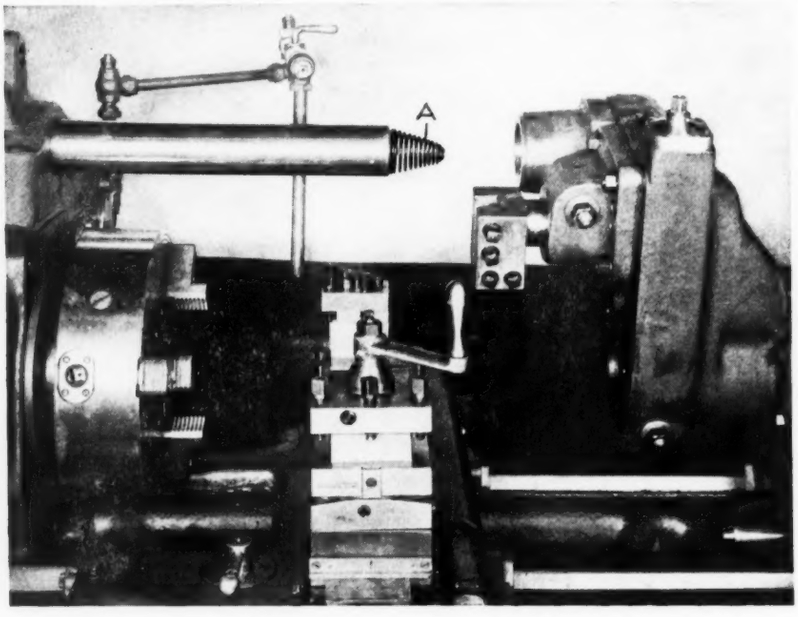
In 1936, Alfred Herbert, Ltd., Coventry, England, patented a safety device for use on turret lathes, which was intended to prevent the accidental trapping of operator's fingers between the end of the overhead support bar and the bushing on the turret tool-holder. The original device consisted of a rubber sleeve attached to the tool-holder or a rubber buffer fastened to the end of the support bar.

Owing to the shortage of rubber, it recently became necessary to find a substitute for this type of safety device. After some experimental work, it was found that a conical spring, as shown at *A* in the illustration, was equally effective in protecting an operator from severe injury or loss of a finger in case he carelessly rested his hand on the overhead support bar while the automatic feed was engaged. The spring safety buffer is now supplied as standard equipment on all turret lathes made by Alfred Herbert, Ltd. This company, feeling that all machine operators should be protected by the safety device, has announced that anyone may make use of the invention.

* * *

DuPont Gets Safety Award

E. I. du Pont de Nemours & Co., Wilmington, Del., was recently presented with a special award of honor by the National Safety Council. In making the award, Colonel John Stilwell, president of the Council, said that the du Pont Co. had one of the finest safety records ever made by any industrial organization in the United States. Thirty-eight of the du Pont plants have had no reportable accident in eighteen months and one of those plants had previously established a world's record of more than 11,000,000 man-hours without an accident.



Turret Lathe Equipped with Safety Device A Designed to Protect Operator's Fingers

POWER
-packaged for Victory

DEADLY in its compact power—this carrier-based plane provides the sting that makes great naval air victories possible.

"A motor with wings," it has been aptly termed, for a single engine of more than 2,000 horsepower roars this mighty ship to Victory.

Engines of such tremendous horsepower are possible because of new techniques in engineering and manufacture, not the least of which have been the advances made in the Foote Bros. Gears that power them. For an engine of this size—swinging propellers at high speed offers problems in gear design and manufacture that, until a few months ago, might well have been considered unsolvable.

How well these problems were solved is evidenced by the flow of Pratt & Whitney engines rolling off production lines in huge engine plants throughout the country. The extreme precision of the gears is a tribute to the engineering back of them, but even more to the new methods of manufacture that have made their mass production possible.

When the war is won these gears, produced in the Precision Gear Plant of Foote Bros., can be applied to peacetime engines and peacetime machines. Manufacturers are then assured of a new era in the transmission of power through gears and speed reducers—an era of more compact, more efficient machines.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 South Western Boulevard • Chicago, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

NEWS OF THE INDUSTRY

California

DETROIT REX PRODUCTS CO., metal cleaning engineers, have moved their Los Angeles office to new and larger quarters at 1506 Santa Fé Ave. S. B. CROOKS has been transferred from the midwestern region, with offices in Chicago, to the Pacific region of which he becomes manager. W. A. VENSEL, formerly Pacific region manager, will supervise sales and service in the Southern States.

Illinois and Indiana

ARTHUR J. O'LEARY & SON CO., 5757 W. 65th St., Chicago, Ill., has changed its name to the KELLY O'LEARY STEEL WORKS. In recent years, in addition to enlarging its forging division, the company has extended its lines into steel fabricating, welding, and machining work.

HARRY M. COLEMAN, publicity director for MacFarland, Aveyard & Co., Chicago, Ill., for the last four years, has been appointed vice-president in charge of public relations.

A. FRANK GOLICK, assistant general manager of sales of the La Salle Steel Co., Chicago, Ill., has been made general manager of sales.

GEORGE G. HATHAWAY has resigned as sales manager of the Libby Division, International Machine Tool Corporation, Indianapolis, Ind. HARRY W. HEIDERGOTT, who has been with the company for many years, will take over the duties of sales manager.

MAJESTIC CO., Huntington, Ind., has recently put into operation a plant equipped for producing aluminum castings by a special permanent-mold process. The new company will be known as MAJESTIC ALUMINUM CO.

Michigan, Wisconsin, and Minnesota

WILLIAM B. STOUT, well known inventor and engineer, has joined the Consolidated Aircraft Corporation, San Diego, Calif., builder of Liberator bombers and flying boats. Mr. Stout's entire organization—the Stout Engineering Laboratories—has been taken over, and will continue to engage in research work with a view to improving aircraft and allied products and developing new product ideas. Mr. Stout's headquarters will be at Dearborn, Mich., and his laboratories, which are located there, will be known as the Stout Research Division of Consolidated.

LIEUTENANT COLONEL FRANK A. MICKLE has been granted a leave of absence by the University of Michigan from his post of associate professor of mechanical engineering to take the position of chief of the Simplification Section in the Development Branch of the Ordnance Department Tank-Automotive Center, Detroit, Mich.

PERFEX GAGE & TOOL CO. announces the completion of its new plant at 3603 Gaylord Ave., Detroit, Mich. This new plant, which was built expressly for the manufacture of gages, contains 10,000 feet of floor space and is provided with air-conditioned lap and inspection rooms.

KOEBEL DIAMOND TOOL CO., Detroit, Mich., announces that, for the second time in two years, the company has found it necessary to move to larger quarters. The new quarters are at 9456 Grinnell Ave., and afford more than twice the previous floor space.

GORDON F. HESS has been appointed district sales manager at Detroit for the Republic Steel Corporation, Cleveland, Ohio. Mr. Hess has been serving as district sales manager at Houston, Tex. He succeeds ARTHUR SCHAEFFER, who is retiring.

FRANK A. HAAG, formerly eastern manager of the Kold-Hold Mfg. Co., 424 N. Grand Ave., Lansing, Mich., has been appointed sales manager, with headquarters in the main office at Lansing. Mr. Haag succeeds PAUL H. PORTTEUS.

QUALIFIED GAGE CO. has removed its general offices and manufacturing plant to 2212 Puritan Ave., Detroit, Mich.

DAVIS & THOMPSON CO., manufacturer of planer type milling machines and other high-production machine tools, announces the removal of its offices to 6411 W. Burnham St., Milwaukee, Wis.

ARNOLD W. NELSON has been appointed district representative in the Minneapolis territory of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., succeeding the E. L. SANDBERG CO. Mr. Nelson's address will be 3512 Glencrest Road, Minneapolis, Minn.

New England

J. EDWIN DOYLE has been appointed assistant to the manager in charge of labor relations at the General Electric Co.'s Lynn River Works, Lynn, Mass. He was previously supervisor of the personnel department of the company's Everett Works.

ALBERT C. DELMONT has been appointed research director of the newly organized research and laboratory departments of the Douglas T. Sterling Co., Stamford, Conn., management consultants.

New Jersey

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J., has recently opened a new fourteen-room first-aid hospital for its employes. Medical facilities have been maintained by the company since 1908, but the new hospital will greatly extend these facilities. It is completely equipped to take care of any emergencies, the equipment including a surgical or operating room and a physiotherapy room. The staff includes a physician and five nurses. New employes of the company are subjected to a medical examination, and all employes are encouraged to visit the hospital in case of any injury or illness. Periodic physical examinations are given to the employes, and the hospital facilities are also available for the treatment of minor non-occupational illness.

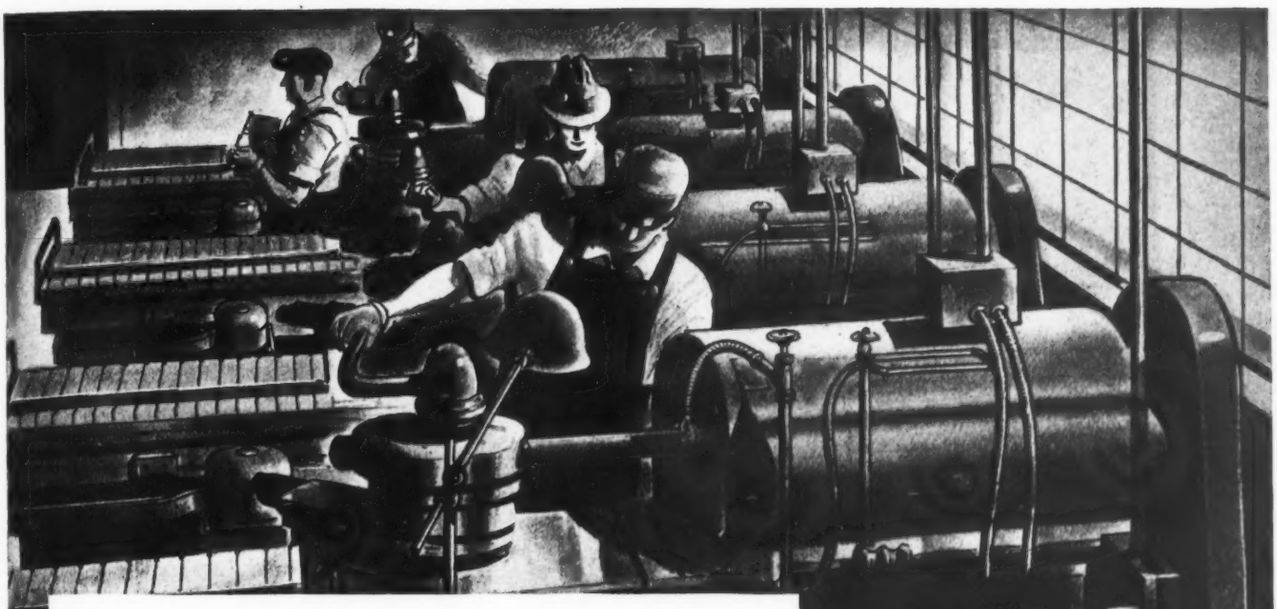
WENZEL HAVEL, a fifty-five-year old former Austrian soldier, has received special recognition at the Westinghouse Lamp Division at Belleville, N. J., for record attendance. Mr. Havel has maintained a perfect record for nine years. Since he joined the Westinghouse organization in July, 1933, he has never been absent a day nor been late for work, although he makes a ten-mile bus trip from his home and reports for work at 7 A.M. Competition to reduce absenteeism is being conducted among plant divisions and departments at the Westinghouse Lamp Division. Each month a pennant representing the winning division will fly from the flagstaff at the plant making the best record.

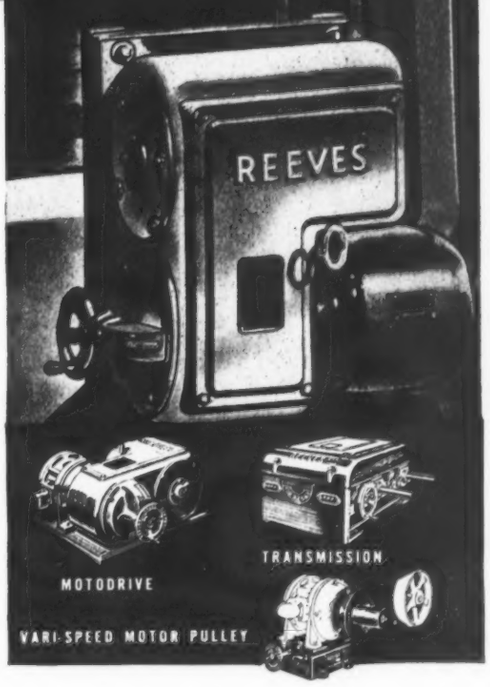
WESTINGHOUSE LAMP DIVISION, Bloomfield, N. J., announces that sixteen employes were recently given War Production Board Awards for ideas that have increased output and saved critical materials in the manufacture of war equipment. The employes were also given checks by the Westinghouse company for their susggestions.

BERNARD H. SULLIVAN, manager of sales for the Westinghouse Lamp Di-

They made 4 machines do the work of 5

by installing REEVES Variable Speed Drives





★ ★ ★ Twenty-five per cent more output of gun parts, *with no extra machinery, no extra labor and no extra floor space,* is one way to win the battle of production and beat the Axis.

A Detroit machine shop accomplished this increase by installing REEVES Variable Speed Drives on the lathes *they had.* This not only made four machines—*and four operators*—do the work of five, but gave greater precision in machining. These results are not unusual. Productive capacities of men and machines are often doubled with REEVES units, which provide full-range, stepless speed adjustability. Operators can always run REEVES-equipped machines at the *best* speeds for each changing condition.

The faster tempo of the war dictates use to the limit of plants we have *right now*—and REEVES Speed Control, available in many models and sizes, insures increased output and greater accuracy on all types of driven machines *now in service.* Standard on 1,440 different makes of new machines. Booklet MG-423 tells the story. Write for it.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES *Accurate Variable* SPEED CONTROL

vision, Bloomfield, N. J., has been assigned responsibility for all commercial activities involving lamps and special products. RALPH C. STUART has been appointed manager of manufacturing and engineering.

J. D SHAW, formerly research and production engineer with the Metals Disintegrating Co., has joined the Aircraft Parts Development Corporation, Summit, N. J. His duties will be concerned with the application of metal powders in airplane production.

JOHN ROSEVEAR, an engineer of twenty years' service with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed staff assistant in the industrial engineering and equipment department of the Westinghouse Lamp Division, Bloomfield, N. J.

New York

O. W. TRUMBULL has been elected vice-president and general manager of Greene, Tweed & Co., Bronx Blvd. and

O. W. Trumbull, New Vice-President and General Manager of Greene, Tweed & Co.

238th St., New York City. Mr. Trumbull was formerly with the Asbestos Textile Co.

PEARSON ENGINEERING CORPORATION has been reorganized, with offices at 41 E. 42nd St., New York City, to engage in activities as general and industrial engineers. This organization was founded fifty years ago by the late Dr. Fred Stark Pearson. The president of the company is FREDERICK A. PEARSON; vice-president, HARRY C. HOEFT; and chairman of the board, H. P. HARRSEN.

PHILIP D. REED, chairman of the board of the General Electric Co., Schenectady, N. Y., has resigned all of his company posts in order to continue his work in London as deputy chief of the Harriman Mission, which covers many fields of war activity.

AMERICAN MEASURING INSTRUMENTS CORPORATION, manufacturer of jigs, fixtures, gages, and measuring instruments, announces its removal to larger quarters at 240 W. 40th St., New York City.

JOHN A. ROSS has recently been appointed manager of the alloy sales department of the Crucible Steel Co. of America, and will be located in New York City.

Ohio

J. H. COOPER has been appointed chief of the Resistance Welding Section, General Industrial Equipment Division, of the War Production Board. Mr. Cooper has been granted an indefinite leave of absence by the Taylor-Winfield Corporation of Warren, Ohio, with whom he has been associated for the last six years as welding engineer. Prior to this, he was connected for nine years with the General Electric Co., specializing in arc-welding.

B. DELORENZO has been made manager of the heat transfer department of the Brown Fintube Co., Elyria, Ohio, manufacturer of resistance-welded, integrally bonded fintubes and heat exchangers.

E. W. HUSEMANN has been appointed metallurgist for the Copperweld Steel Co., Warren, Ohio. He was formerly connected with the Republic Steel Co. at Chicago, Ill.

Pennsylvania

W. W. NOBLE has been appointed manager of the Pittsburgh branch sales office of the Crucible Steel Co. of America, 405 Lexington Ave., New York City. J. S. BILLINGSLEY, formerly branch manager of this office, was recently made manager of the order and scheduling department at the New York offices. Mr. Noble was previously manager of the Cleveland office of the Pittsburgh Crucible Division.

PERCY E. RHICARD, works tool engineer at the East Springfield plant of the Westinghouse Electric & Mfg. Co., SAMUEL W. CHANTLER, superintendent of the Canton, Ohio, Division of the Westinghouse organization, and PERCY N. LOVE, industrial relations supervisor at the same plant, all have been awarded the Westinghouse Order of Merit for their achievements in speeding war production.

RAYMOND M. DENNIS has been appointed assistant to the president of the By-Products Steel Corporation, Coatesville, Pa., a subsidiary of the Lukens Steel Co. He will have charge of the staff and general administrative work for the corporation. JOHN S. MORRIS has been appointed methods engineer. He will carry on special development work in connection with improved methods.

W. ROY WIDDOES has been made director of personnel relations for the Lukens Steel Co., Coatesville, Pa., and its subsidiaries. He succeeds CHARLES L. HUSTON, JR., who was recently made assistant to the president. Mr. Widdoes was previously general manager of the By-Products Steel Corporation, a Lukens subsidiary.

DAVID W. HOPKINS, secretary and director of the R-S Products Corporation, Wayne Junction, Philadelphia, Pa., for a number of years, has been elected vice-president. Mr. Hopkins will continue in charge of the company's Valve Division.

T. C. FOCKLER, of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed a member of the American Standards Association's Sub-committee on Ball and Roller Bearings and Standardization of Shafting.

ROBERT H. GIBB, assistant district manager of the Pittsburgh district sales organization of the Allegheny Ludlum Steel Corporation, has been appointed district manager.

* * *

Research Men Needed for War Work

Westinghouse Electric & Mfg. Co. has discontinued for the duration of the war the Research Fellowships awarded annually to young scientists in order to enable them to continue their studies at the company's research laboratories. On account of the war effort, pure research is being carried on now only where it will further war production. There is, however, a shortage of highly trained men for this work. Correspondence would be welcomed by the Westinghouse company with men who would be interested in joining those now engaged in the Westinghouse plant in developing new devices and new material for our armed forces and those of our Allies. Such correspondence should be addressed to the Manager of Technical Employment and Training, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

There are—to be exact—6468 accurately ground and sharp cutting edges on that particular Michigan rotary gear finishing cutter (*). Each cutting edge acts like a separate cutting tool and does its own share of the work in finish-machining gears.

That's one reason why you can produce gears so accurately and so fast on Michigan Crossed-Axis gear finishing equipment. It makes no difference either, whether your gears are ¼ inch in diameter or stand many feet high: there is a Michigan Gear finisher for every size class.

** The illustration shows an average cutter (64-pitch; 10° helix angle) for the new Michigan 861 light duty gear finisher (see small cut), designed for gears from ¼ to 4 inches in diameter.*

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD • DETROIT, U. S. A.

OBITUARIES

Henry C. Pierle

Henry C. Pierle, secretary and general sales manager of the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, and internationally known machine tool salesman, died on January 14 at Christ Hospital in Cincinnati, following a heart attack and an illness

Henry C. Pierle

of several weeks. He was sixty-two years old. Mr. Pierle was born on November 27, 1880, at Cincinnati. He was educated in the elementary schools of that city and received his engineering training at the Technical School and University of Cincinnati. He began work as a machine shop hand, being employed, in turn, by the Lodge & Shipley Machine Tool Co., the Cincinnati Bickford Tool Co. and the R. K. LeBlond Machine Tool Co. Associated with the LeBlond company for thirty-two years he had been sales manager since 1918. He was past-secretary of the National Machine Tool Builders' Association. He had traveled widely through Europe as a representative of his firm and had an international reputation as an expert in the manufacture of gun barrels. In this capacity, he performed a most valuable service for his country.

R. K. LeBlond, founder of the R. K. LeBlond Machine Tool Co., paid Henry Pierle the following tribute: "His work and advice were prime factors in the success of this company. His genial disposition and optimistic outlook helped us through the low periods of this business more than anything else. In every way, Henry Pierle was everything a man should be. Every person connected with this company in any way will sustain a great loss through his death."

Mr. Pierle is survived by his widow and two sisters.

CLIFFORD A. NICKLE, consulting engineer with the General Electric Co., Schenectady, N. Y., died on December 8 at Schenectady. Mr. Nickle was born in Sharpsville, Pa., and was graduated from the Pennsylvania State College in 1918 with a degree in electrical engineering. He entered the General Electric test course at the Erie, Pa., Works in 1920, after serving as an instructor in the United States Army Signal Corps until the end of the first World War. In 1923, he was made assistant to the late Dr. Charles P. Steinmetz. Mr. Nickle was one of the few men in the world to produce artificial diamonds for use in industry as abrasives.

GUY R. WASHINGER, assistant sales and advertising manager of the T. B. Wood's Sons Co., Chambersburg, Pa., died suddenly on December 22 at the age of fifty-three years. Mr. Washinger had been connected with the company for thirty-five years.

COMING EVENTS

APRIL 28-30—WAR PRODUCTION CONGRESS and annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION in St. Louis, Mo.; headquarters, Hotels Jefferson and Statler. C. E. Hoyt, executive vice-president, 222 W. Adams St., Chicago, Ill.

* * *

A.S.T.E. to Hold Machine and Tool Progress Exhibit

As the result of demands from industry, the American Society of Tool Engineers has decided to reverse its previous decision and hold a 1943 Machine and Tool Progress Exhibition in connection with the Society's annual meeting in Milwaukee on March 25 to 27. The demand for the show arises primarily from the current urgency for simplifying the nation's war production job, due to the increasing introduction of unskilled labor, the greater acuteness of the industrial man-power situation, and the need for further increases in production schedules, while conserving materials to the utmost. Further information can be obtained from Adrian L. Potter, executive secretary, 2567 W. Grand Ave., Detroit, Mich.

Recent Army-Navy "E" Production Awards

The following companies in the metal-working and allied industries have recently received the Army-Navy "E" Award:

Babcock & Wilcox Co., Augusta, Ga.

Bakewell Mfg. Co., Los Angeles, Cal.

Buffalo Forge Co., Buffalo, N. Y.

Cleveland Automatic Machine Co., Cleveland, Ohio.

Dow Chemical Co., Midland, Mich.

Fulton Sylphon Co., Knoxville, Tenn.

General Asbestos & Rubber Division of Raybestos-Manhattan, Inc., North Charleston, S. C.

Horni Signal Mfg. Corporation, New York City.

Lincoln Park Tool & Gage Co., Lincoln Park, Mich.

Republic Steel Corporation, Canton and Massillon, Ohio, plants and Birmingham and Gadsden, Ala., plants.

S. G. Taylor Chain Co., Hammond, Indiana.

William Pascoe, a Blacksmith in the Employ of the Moline Tool Co., Moline, Ill., was Ninety Years Old on January 20. He Started to Work for the Moline Tool Co. Twenty Years Ago, at an Age when Most Men would have been Retired for Five Years. He has the Privilege of Reporting for Work only when He Wants to, but He is on the Job Winter and Summer, Usually Five Days a Week

AFTER CUTTING OILS–WHAT?

A statement of tremendous interest to everyone engaged in metal working

SINCE OIL first replaced water as a tool coolant many years ago, the development of various compounded oils and water emulsions has helped make possible present day mass production. However, we at Quaker Chemical Products Corporation were convinced that the cutting fluids now in general use represent only one step – a comparatively early step – in the continuing evolution of tool coolants. We, therefore, determined long ago to anticipate the *next* step.

In our superbly equipped research laboratories a picked staff of chemical engineers went to work to find out just how and why a cutting fluid works.

Lubricity—What Is It?

Every liquid, of course, possesses some degree of "lubricity" – the ability to form a protective film against friction – but we wanted to learn much *more* than this fixed definition. Once we learned the "how" and the "why," we would know the fundamental *causes* of known results. This, we felt, would give us the basis for developing something startlingly new.

Now, as our research advances, we realize more than ever how much there is yet to be added to the total knowledge of the subject. But our men have already uncovered many facts which have enabled us to develop *new types* of chemical fluids for use in metal machining.

Some of these new type products are now producing sensational results in actual large scale production . . . helping to turn out more and finer finished parts for the tanks, planes and guns needed by our armed forces.

Can Straight Cutting Oils Be Replaced?

These new materials are synthetic, organic compounds that form permanent emulsoid solutions. They act as *polar* emulsions and actually plate-out on the metal a lubricating film that is far more tenacious than oil. *These solutions can be used wherever straight cutting oils are used,* except in cases where water might affect bearings of certain machines. This is, of course, only a mechanical limitation.

Think of a mixture of chemicals and water producing better – yes, *better* – results than sulphur fatty oils on difficult machining jobs such as broaching, deep drilling, milling and similar jobs! Seems almost incredible, doesn't it? Yet, when you consider that the lubricating film is more adhesive than oil and that the superior refrigerating qualities of water are utilized, it is easier to understand how these new type products not only can replace straight cutting oils, but can actually permit tools to run for longer periods between grinds. Being water solutions, they are also a great deal more pleasant to work with than are oils.

Production Data Now Available

For the benefit of production men who are interested in keeping abreast of developments resulting from Quaker's research, we have prepared authentic technical data sheets. Some contain facts on the appearance, characteristics, use and application of new products. Others give specific data on various machining jobs – actual plant production reports by Quaker Process Engineers. All are yours for the asking.

Quaker Process Engineers are located in leading industrial centers. They are trained technical men who have had years of experience in metal processing plants. Before they came with us they "cut their eye teeth" as chemists, metallurgists, methods engineers or superintendents of industries such as yours. They talk your language and know how to translate our new developments into increased production.

Should you be interested in knowing just what our new type coolants can do to help you handle a difficult metal cutting problem – or possibly to increase machine production throughout your plant – drop us a line. A Quaker Process Engineer will be glad to sit down and talk shop with you.

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

NEW BOOKS AND PUBLICATIONS

DIE-CASTING FOR ENGINEERS. 148 pages, 6 by 9 inches; 67 illustrations. Published by the New Jersey Zinc Co., 160 Front St., New York City. Price, $1.

During recent years, the process of die-casting has become recognized as one of the more important high-speed production methods in the metal-working industries. The present book has been prepared to be of assistance to students in engineering colleges, as well as to engineers already engaged in industry, who wish to become thoroughly familiar with a process that appears to have almost unlimited possibilities. In preparing the book, an effort has been made to present an impartial analysis of the many alloys in use for die-castings, so the engineer can form a proper perspective of the inherent advantages of the die-casting process as applied to different kinds of die-casting materials.

Briefly, the book deals with the history and growth of die-casting, and the principles and history of die-casting machines. It then deals in considerable detail with alloys for die-casting; die construction; die-casting applications; specifications; inspection and tests; methods and tools for flash removal; machining practice, including jigs and fixtures for machining die-castings; finishes for die-castings; and principles applied in the design of die-castings. The book is provided with a comprehensive index, making it convenient for ready reference.

MACRAE'S BLUE BOOK (1942-1943). 3728 pages, 8 1/4 by 11 inches. Published by the MacRae's Blue Book Co., 18 E. Huron St., Chicago, Ill. Price, $15.

This is the fiftieth annual edition of a buying guide covering all the manufactured products in the United States. The arrangement is the same as in previous editions, the first section consisting of an alphabetical list of manufacturers, together with addresses and the names of local distributors. The second and main section of the book is the Classified Material Section covering 2735 pages, which lists the manufacturers according to their products.

Following the Classified Material Section is the Trade Facilities Section, listing the names of towns in the United States having a population of 1000 or more, the leading commercial bodies, banks, railroads, and storage and distributing warehouses. Airports are indicated. The Trade Name Section gives the trade names of the various products, together with the names and addresses of the manufacturers.

The book is carefully indexed and cross-indexed, which makes the finding of the desired information quick and easy. It has proved to be a valuable aid to purchasing agents, sales departments, and all those who need to make a list of manufacturers or of products made in the United States.

ENGINEERING DRAWING. By Leon M. Sahag. 394 pages, 6 3/4 by 10 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $2.75.

The material in this text-book on engineering drawing is based on both industrial and teaching experience of the author extending over a number of years. It has been extensively used in drawing classes and, therefore, tested in meeting the requirements of a basic engineering drawing course. The purpose of the author, in preparing this text, is to offer the maximum of training in the minimum of space and time.

The text is divided into three parts —elementary, intermediate, and advanced. The first two parts include what is necessary to any basic course, such as lettering, use of drawing instruments, geometrical drawing, projection, technical sketching, working drawings, manufacturing methods, materials of construction, etc. The third part deals with advanced work, including developments, sections, and intersections of solids; perspective projection; charts and graphs; jigs and fixtures; elementary machine design; and patent drawing. The fourth section of the book contains problems and includes many practice drawings.

INDUSTRIAL INSPECTION METHODS. By Leno C. Michelon. 389 pages, 8 by 11 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $3.50.

The great demand for ordnance material, aircraft and engines due to the war has resulted in a critical need for precision inspection. Up to the present time, little instructional information on inspection methods and procedures has been available. This book, therefore, has been written to help in the training of inspectors so urgently needed at the present time. It has as its aim the explanation and illustration of the correct use and application of precision measuring instruments, along with the problems related to the precision inspection of ordnance materials. The main part of the book is divided into four sections treating, respectively, of Dimensional Control; Testing for Physical Properties; Surface Inspection; and Inspection Organization. The fifth section, which comprises an appendix, contains tables of data useful to the inspector, such as decimal equivalents, tap drill sizes, logarithms, trigonometric functions, drilling cutting speeds, etc.

READING AIRCRAFT BLUEPRINTS. By Francis L. Goff and Lloyd R. Novak. Blueprint Section, 45 pages, 8 by 10 inches; Instructions and Questions Section, 76 pages, 6 by 9 inches. Published by McKnight & McKnight, 109 W. Market St., Bloomington, Ill. Price, $2.

This book on reading aircraft blueprints is divided into two parts: One section contains instructions and questions covering fundamental knowledge of blueprint reading, including conventional symbols, and giving essential information on the forty-five blueprints in the blueprint section, together with questions on each. The second section contains fifty blueprints showing all the separate parts of the modern plane, as well as assembly drawings. The book first acquaints the student with the complete airplane, and then presents the four main sections of the plane under the classifications Sheet-Metal Aircraft Parts; Standard Aircraft Parts; Forgings, Castings, and Machined Parts; and Assemblies.

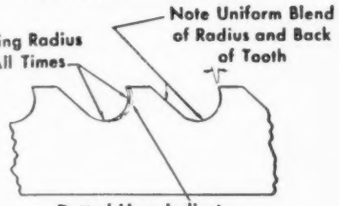
SIMPLIFIED INDUSTRIAL MATHEMATICS. By John H. Wolfe, William F. Mueller, and Seibert D. Mullikin. 281 pages, 5 by 8 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $2.

The authors of this book are all connected in a supervisory capacity with the apprentice training courses of the Ford Motor Co. The purpose of the authors in preparing the book was to familiarize students in the shortest possible time with the essentials of elementary industrial mathematics. The book contains an abundance of simple, practical geometric problems that are part of the day-by-day activities in industry. It covers common fractions, decimals, square root, precision instruments, symbols and formulas, ratio and proportion, tapers, percentage, geometry, trigonometry, screw threads, and gearing.

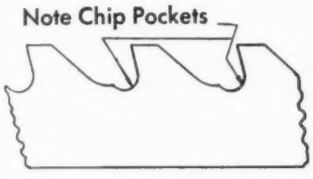
DICTIONARY OF TECHNICAL TERMS. By Frederic Swing Crispin. 372 pages, 5 1/2 by 8 inches. Published by the Bruce Publishing Co., Milwaukee, Wis. Price, $2.50.

This is a revised edition of a dictionary originally publishad in 1929 for students, draftsmen, mechanics, builders, electricians, and workmen generally. It is intended to familiarize

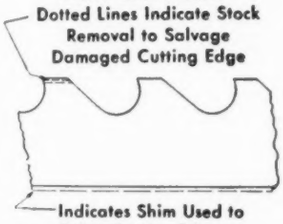
① ILLUSTRATES CORRECT RESHARPENING FORM


Blending Radius at All Times
Note Uniform Blend of Radius and Back of Tooth
Dotted Lines Indicate Stock Removal in Resharpening

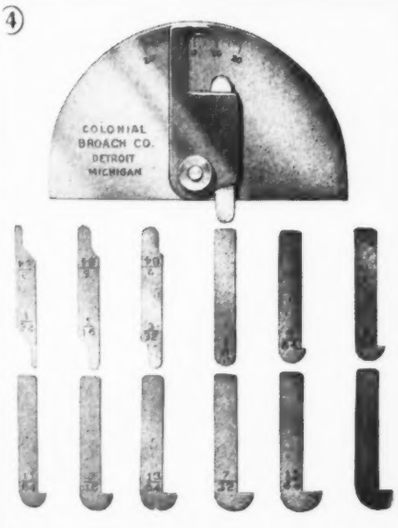
② ILLUSTRATES INCORRECT SHARPENING FORM



③ ILLUSTRATES REGRINDING FOR SALVAGE


Dotted Lines Indicate Stock Removal to Salvage Damaged Cutting Edge
Indicates Shim Used to Bring Cutting Edge to Correct Height

④



How to get more production with your Broaches------

2. BY PROPER SHARPENING

(a) Any marked departure from the original size and form of teeth in resharpening broaches will result in incorrect cutting action. Have the manufacturer supply you with a blueprint for use as a guide.

(b) Always blend the radius of the broach when sharpening teeth. Fig. 1 shows how to successively resharpen a broach.

(c) Don't sharpen a broach in the manner illustrated in Fig. 2. The pockets at the base will prevent chips from clearing the teeth, slow up production and possibly break broach teeth.

(d) Where surface broaches can be adjusted for height, it is permissible to sharpen broaches as shown in Fig. 3. When this is done, care must be taken to maintain proper stepping, backing off and tooth depth.

(e) It is always advisable to check the radius at the bottom of the tooth with simple radius gages as shown in Fig. 4, to keep broaches at peak of efficiency and prevent broach damage from incorrect sharpening.*

(f) Play safe: Don't use makeshift equipment to sharpen broaches.**

*Available in sets at a nominal price from Colonial.

**Colonial Universal Broach Sharpening Machines are equally adaptable to sharpening of both flat and round broaches.

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the users with the technical terms that they are likely to come in daily contact with. The author states that definitions of many of the terms listed are not found in the average dictionary, even though they are in general use. No attempt has been made to include all technical terms, but the purpose has been to make the scope broad enough to give a worker the knowledge of the trade nomenclature that will be useful to him in the pursuit of his vocation.

A.S.M.E. MECHANICAL CATALOG AND DIRECTORY FOR 1943. 562 pages, 8 1/2 by 11 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

The 1943 edition of the Mechanical Catalog and Directory, issued by the American Society of Mechanical Engineers, is the thirty-second annual volume of this directory published for the use of the membership of the Society and for the mechanical engineering profession at large. In addition to the catalogue descriptions usually found in works of this type, this catalogue classifies the products of approximately 4000 manufacturers under hundreds of sub-divisions. There is also a trade name section, which gives an alphabetical list of the trade names of a great many products.

AMERICAN DIESEL ENGINES. By E. F. Goad. 313 pages, 6 by 9 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $2.75.

The author of this book on the operation, maintenance, and repair of American Diesel engines has had extensive experience in teaching this subject in vocational and trade extension classes, and has also had about fifteen years of active work in installing, repairing, and operating Diesel engines. In his teaching experience he felt the lack of a practical text for the vocational student on this subject, and it was to fill this need that the book was prepared. It explains the basic principles of Diesel engines and their fuels, and includes detailed instructions on specific engines and equipment typical of those most generally used in the United States. The book is intended to be an introductory text for pupils of vocational and industrial arts classes and of classes in internal combustion engines of the Army, Navy, Coast Guard, and Air Services.

ENGINEERING MECHANICS. By Bevis B. Low. 252 pages, 5 1/2 by 8 1/2 inches. Published by Longmans, Green & Co., Inc., 55 Fifth Ave., New York City. Price, $4.50.

This book on engineering mechanics is chiefly concerned with kinematics and dynamics, including instantaneous centers, velocity and accelerations diagrams, analysis of cams, motion of rigid bodies in two dimensions, and vibrations of various kinds. In view of the importance of dimensions and dynamical similarity, a chapter is devoted to these subjects. The deflection of beams is also dealt with, some knowledge of this being required in the study of certain vibration problems. Numerous worked-out examples are given in the text, and there are exercises following the chapters in many instances. This book is intended to be a companion book to "Applied Mechanics," written by D. A. Low, father of the author.

A MATHEMATICS REFRESHER. By A. Hooper. 342 pages, 5 1/2 by 8 inches. Published by Henry Holt & Co., 257 Fourth Ave., New York City. Price, $2.50.

This is a simple, concise review of mathematics from fractions and decimals to logarithms and trigonometry. The book was originally published in England, and was written primarily for Royal Air Force candidates whose mathematics had become "rusty." The object of the author was to enable a person of average intelligence to obtain a clear grasp of the essentials of arithmetic, algebra, geometry, and trigonometry with a minimum expenditure of time and effort. The book is suitable for either home or class work. Each section includes test problems to enable the reader to determine if he has grasped the subject and its practical application.

MOTION STUDY FOR THE SUPERVISOR. By Norman R. Bailey. 111 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $1.25.

The purpose of this book is to explain the basic principles of motion economy as simply and clearly as possible. It brings to the supervisor a practical knowledge of motion study as a tool in quickly analyzing operations for ineffective work and in investigating improvements. A simple method of analysis is described that permits the application of motion study to other than high-production operations. The basic knowledge here presented should enable the supervisor to cooperate with the time analyst in eliminating wasted effort.

ESSENTIAL MATHEMATICS FOR SKILLED WORKERS. By Harry M. Keal and Clarence J. Leonard. 293 pages, 5 by 7 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $1.50.

This book has been written to provide the student with the essential mathematics required in making shop computations. Shop theory, however, has been avoided to make the book suitable for students of any applied science. It comprises a brief course in mathematics for those who plan to become skilled workmen or for those who have taken college preparatory courses, but are not going to college. One chapter is devoted to applied problems involving the use of arithmetic, algebra, geometry, trigonometry, and the slide-rule.

MECHANICAL DRAWING. By Ervin Kenison and James McKinney. 330 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $2.

This book is intended to provide the student with the skill and technical knowledge needed in the field of drawing. It gives a certain amount of "drill" work in the use of the instruments employed in mechanical drawing, and shows the student how to become adept in making neat and accurate drawings. The basic principles of projection are thoroughly explained, and many problems in drawing are included.

SCREW THREAD MANUAL. By F. J. Camm. 192 pages, 5 1/2 by 8 3/4 inches. Published by the Chemical Publishing Co., Inc., 234 King St., Brooklyn, N. Y. Price, $2.75.

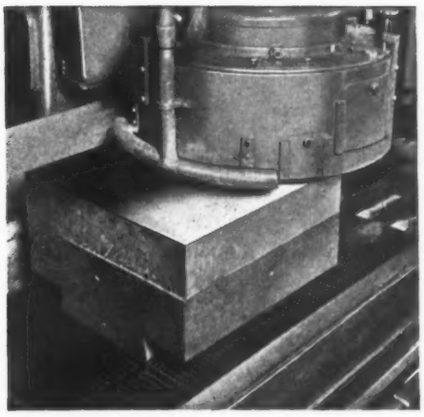
This book describes the screw-thread standards in common use and deals with the various methods of cutting screws, as well as methods of measuring them. It discusses modern developments in screw-thread production relating to thread milling, thread grinding, and the photometric systems of measurement. A chapter is also included on modern methods of nut and bolt production.

ELEMENTARY MATHEMATICS. By Hyman Levy. 216 pages, 5 by 7 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $1.50.

This book on elementary mathematics is one of a group known as "Aeroscience Manuals," covering the various sciences underlying aeronautics. The present book is intended to lay a solid foundation in the mathematics that all students of aeronautics must have. It is written by a professor of mathematics in the Imperial College of Science and Technology in London.

WAR CONTROLS GUIDE — PRIORITIES, PRICE AND RATIONING REGULATIONS. 32 pages, 11 1/2 by 17 inches. Published by the New York Journal of Commerce, 63 Park Row, New York City. Price, 25 cents.

ORGANIZATION AND TRAINING OF INDUSTRIAL FIRE BRIGADES. 119 pages, 6 by 9 inches. Distributed by S. C. Toof & Co., 195 Madison Ave., Memphis, Tenn. Price, $1. (Special quantity discount)



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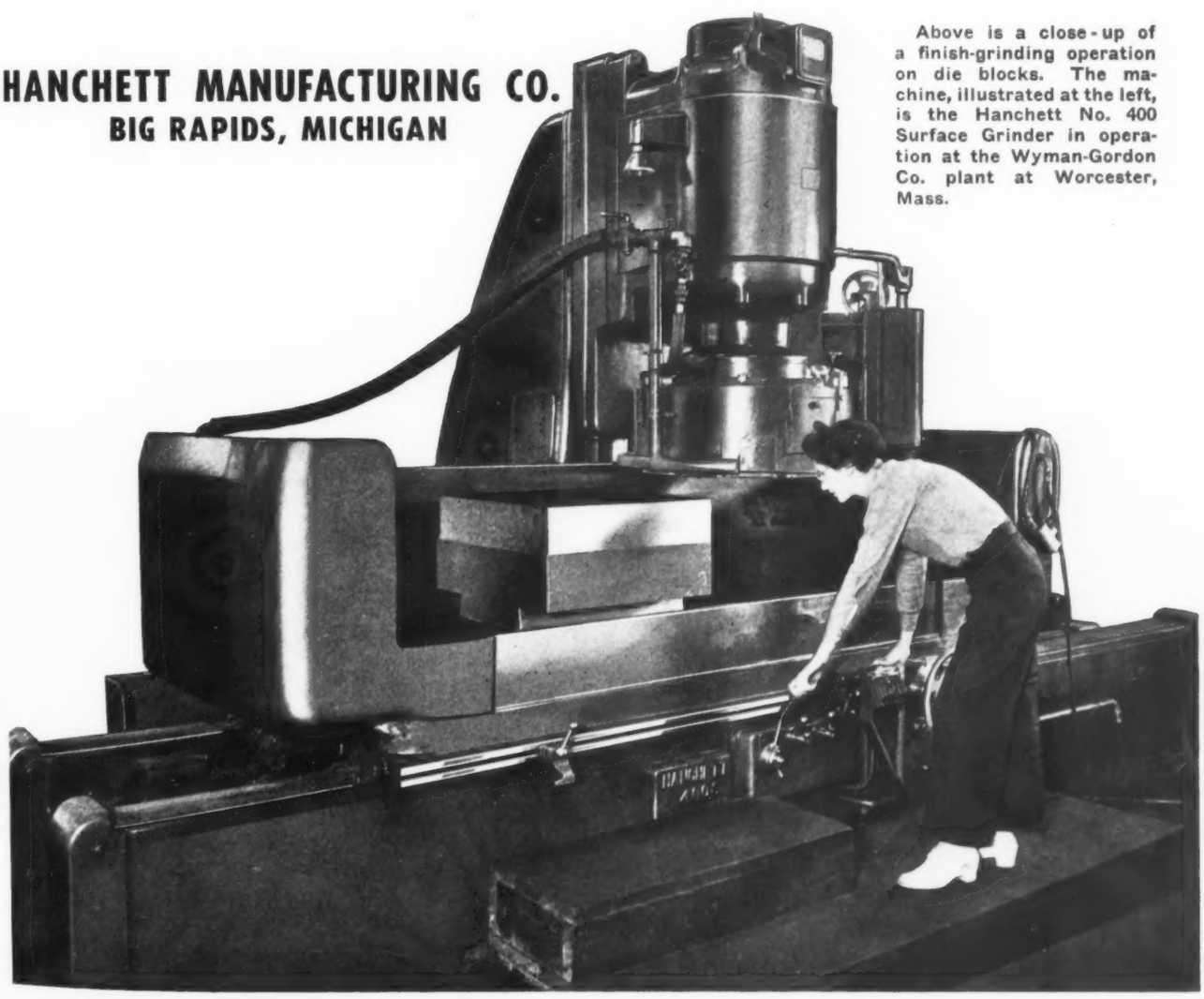

Above is a close-up of a finish-grinding operation on die blocks. The machine, illustrated at the left, is the Hanchett No. 400 Surface Grinder in operation at the Wyman-Gordon Co. plant at Worcester, Mass.

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In 1943, as in 1942, Landis Machines and Equipment will set the pace in Threading for War Production. During the past year, our Engineers have developed new threading equipment that has greatly increased threading production for many industries. Let us tell you about it.

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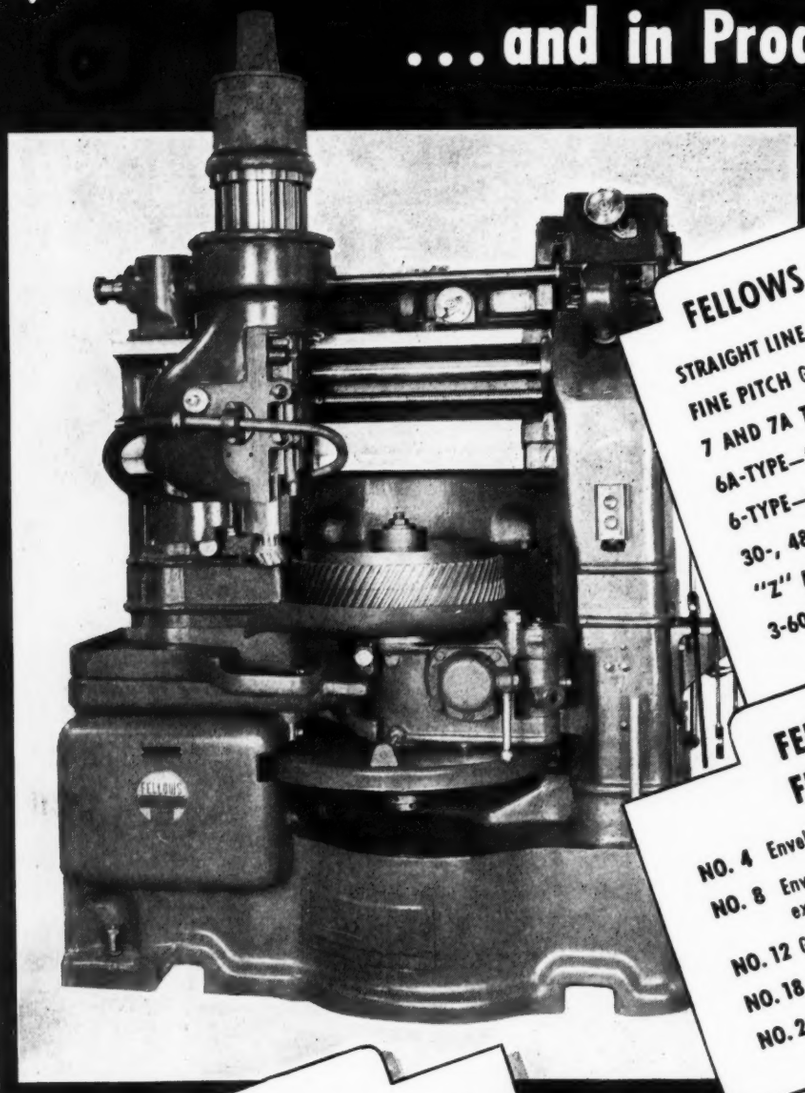

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STRAIGHT LINE Gear Generator—for gears to 1½ ins. diameter.
FINE PITCH Gear Shaper—for gears to 3 ins. diameter.
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NO. 4 Enveloping Gear Generator—for small work.
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GEAR FINISHING TOOLS for spur and helical gear finishing by crossed-axes method.
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RODUCTION

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NO. 4B Helical Cutter Sharpening Machine for cutters with cutting faces normal to helix, up to 4 ins. pitch diameter, ¾ diametral pitch, and 50 degrees helix angle.

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12 INCH CIRCULAR PITCH TESTING FIXTURE.

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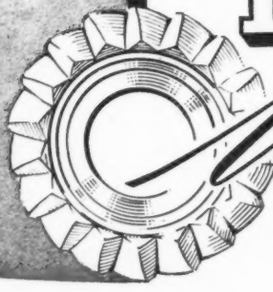

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Method

MACHINES AND TOOLS FOR GEAR PRODUCTION...FROM BLANK TO FINISHED GEAR

And the curious thing is that he had!

That incredible bandwagon is actually the missing link between the Iron Horse and a dray horse. It combined the best features of a locomotive — steam — and a quadruped — *legs!*

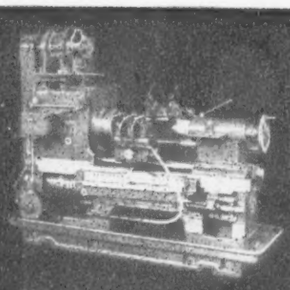
For a horse's legs, brother Gordon reasoned with stirring logic, had always been the extremity of efficient hauling power, hence they always would be. So he built *mechanical* legs for his dream of motive power. . . . The spirited vehicle pranced itself to pieces, and Gordon's dream was ended.

Yet, in 1824, David Gordon had something that might have made mechanical history. It was *traction* that he was striving for, never dreaming that the wheels alone would give enough of it to pull his steam-driven carriage . . . while the regrettable legs on that hybrid hack were remarkably close in principle to the caterpillar-type of traction used today on tanks and tractors!

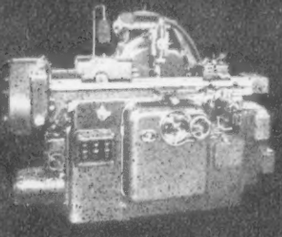
This story has a modern moral. For every engine and every machine that runs today represents many failures, many successes — and many problems that are still in the process of being solved. And in the solutions of those problems lie the great discoveries of the future!

Today, Jones & Lamson engineers and service men are working with leading technical men in virtually every industry and in hundreds of plants, from the largest to the smallest, helping to solve those problems. And behind them is a background of machine tool engineering that spans more than a century of our industrial history — since the days of David Gordon.

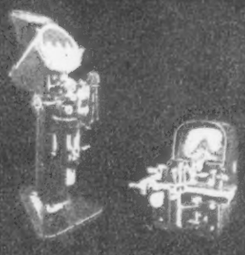
No matter what your problem—or when—Jones & Lamson engineers are at your service. Call upon them!



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS



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You've Got Something There!

DURING a single year of this war, with its problems of changing production, American manufacturers —from the largest to the smallest— have called upon Jones & Lamson many thousands of times for counsel, service or precision machine tools.

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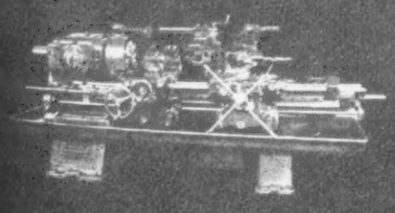

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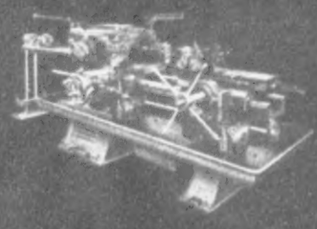

RAM TYPE
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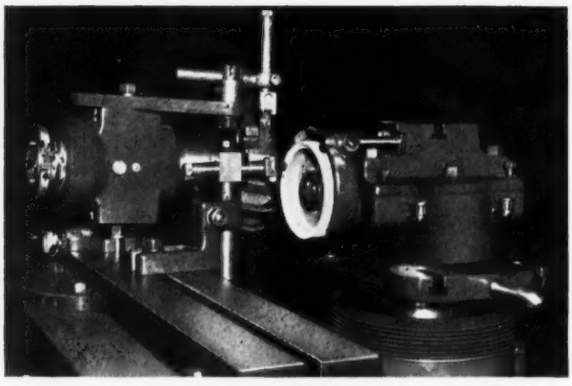
A PRACTICAL GUIDE TO

greater production p

EXCERPTS FROM THE PAGES OF THIS INTERESTING BOOKLET



GRINDING THE FACE OF MILLING-CUTTER TEETH

GENERAL INSTRUCTIONS FOR SHARPENING MILLING CUTTERS

A poorly sharpened cutter increases the cost of milling in several ways. First, the cost of sharpening is increased, because the cutter must be sent to the tool maintenance man for regrinding more often than would otherwise be necessary. And secondly, the life of the cutter is shorter, since the useful life is directly proportional to the number of grinds necessary to keep the cutter sharp and in good condition. Thirdly, time is wasted in replacing a dull cutter with a sharp one. Lastly, there will probably be a greater proportion of inferior milled surfaces rejected by the inspection department.

General purpose cutters should be ground for the kind of material on which the cutter is to be used, adhering to established standard clearance angles for different types of cutters such as face mills, spiral mills, end mills, thread milling cutters, etc. Relatively small diameter cutters can be given a smaller clearance angle, as the feed is usually reduced in proportion to the size of the cutter.

PRACTICAL CUTTER GRINDER SET-UPS

LONG END MILLS

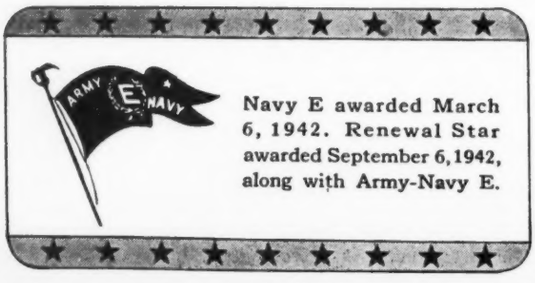
End mills which are too long to grind the face of the teeth in the conventional manner, may be ground on the CINCINNATI No. 2 Cutter Grinder with the set-up illustrated. Up to 8" flute length may be accommodated in this manner. However, the range of cutter diameter is limited, because the overhanging table limits the traverse movement of the slide.

ANGULAR CUTTERS

Like any other type of cutter, straight tooth angular cutters may be sharpened by either the disc wheel or cup wheel methods. When using the cup wheel method, the clearance angles are obtained by rotating the cutter a given angle, bringing the cutting edge to be ground below the center of the wheel. Because of the taper of the cutter, the large end travels a greater distance away from the wheel when the cutter is rotated through the clearance angle. With the tooth rest mounted on the table or headstock, this method produces a variation in width of land. On the other hand, with the tooth rest mounted on the wheel head, the clearance angle will vary. Therefore, this method of grinding straight tooth angular cutters should be avoided. The best practice is to use a disc wheel, because the clearance is then created by the curvature of the wheel, and mount the tooth rest on the wheel head.

CUTTER LIFE INCREASED by ROUNDING CORNERS

In sharpening face and end mills the usual procedure is to grind a 45 degree corner on the teeth. Sometimes an attempt is made to obtain an approximate radius by three grindings: 22½ degrees, 45 degrees, and 67½ degrees. Even then the corners are still present, and although they are not so pronounced, they are the starting points for premature wear.



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

THE CINCINNATI

TOOL ROOM AND MANUFACTURING

TO . . .

per cutter

GRINDING OF CEMENTED-CARBIDE MILLING CUTTERS

As a result of the relative brittleness of cemented carbides, producing a sharp cutting edge on these materials, is also much more difficult than on steel. Grinding must, therefore, be done by removing a little material at each pass without trying to take the metal off too fast. Pressure between the tool and the grinding wheel must be light, and a constant motion in the direction of the feed must be maintained, to prevent localized heating of the cemented-carbide tip.

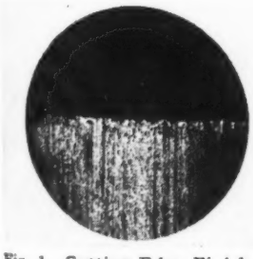


Fig. 1. Cutting Edge Finish Ground With a Fine Abrasive Wheel (100X).

Fig. 2. Cutting Edge Finish Ground With a Fine-Grit Diamond-Wheel (100X).

The booklet illustrated, "Discussion of Everyday Problems in Cutter Sharpening," another official communique from Milling Headquarters, is yours for the asking.

AN ACTUAL CASE

	CORRECTLY Sharpened Cutter	INCORRECTLY Sharpened Cutter
Cost of Cutter	$36.80	$36.80
Maximum Wear	1" on dia.	1" on dia.
Stock Removal per Grind	.004"	.008"
Possible Number of Grinds	$\frac{1.000}{.004} = 250$	$\frac{1.000}{.008} = 125$
Pieces per Grind	15	4
Pieces per Cutter	$15 \times 250 = 3750$	$4 \times 125 = 500$
Cutter Cost per Piece	$\frac{\$36.80}{3750} = \$.0098$	$\frac{\$36.80}{500} = \$.073$

LIFE OF CUTTER RATIO — 7½ to 1

CINCINNATI

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

MILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

This will help

YOUR GRINDER SE

SOME machines can be operated quite successfully with no knowledge whatever of how they work or their basic principles of construction. Business machines, household equipment, and radios necessarily fall within this classification. So, too, can CINCINNATI Centerless Grinders be operated with a minimum knowledge of the principles upon which they operate. Nevertheless, this type of information is highly important to set-up men and supervisors if they are to obtain continuous operation of the machines at a high rate of production.

The booklet illustrated at the right, "Principles of Centerless Grinding," is another official communique from Grinding Headquarters, and explains principles and methods, briefly discusses wheels and blades, and contains tables of thru-feed traverse rates. It is offered free to those working with centerless grinders or interested in the centerless method of precision cylindrical grinding.

A FEW PAGES FROM THIS BOOKLET

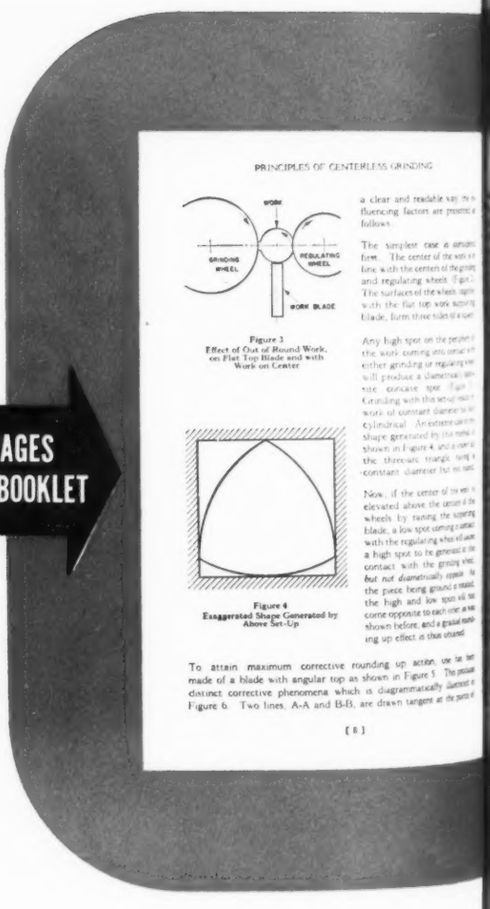
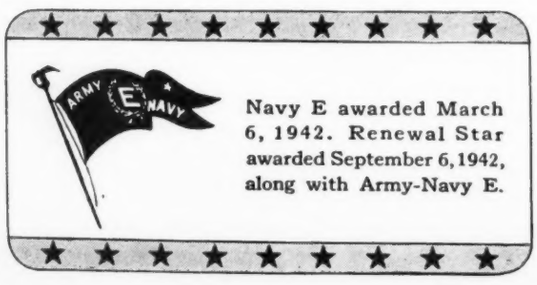

PRINCIPLES OF CENTERLESS GRINDING

Figure 3
Effect of Out of Round Work, on Flat Top Blade and with Work on Center

Figure 4
Exaggerated Shape Generated by Above Set-Up

[6]



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

CINCINNATI G

CENTER TYPE GRINDING MACHINES

CINCINNATI

ERSET-UP MEN

BASIC PRINCIPLES

Figure 5
Maximum Corrective Round-Up Action Obtained with this Basic Set-Up

Figure 6
Diagrammatic Sketch of Corrective Action

[9]

	Diamond			
	Rough Grinding	Finish Grinding	Rough Grinding	Finish Grinding
Grinding Wheel	10 to 20	4 to 7	40 to 60	10 to 20
Regulating Wheel	1 to 2	1 to 2	not used	not used

Figure 19
Regulating Wheel Truing Attachment

Regulating Wheel Truing Equipment. A brief description of the regulating wheel truing attachment, Figure 19, is given here, because it is peculiar to the centerless machine. Diamond "A" from one to two carats in size, is mounted in a $\frac{7}{16}$" diameter rub 1" long. This rub is fastened in diamond holder "G", which is secured to adjustable sleeve "C" by means of screw "H". The sleeve, which can be moved vertically through its housing, is clamped in position by means of screw "B". Dial "E" is for accurate adjustment of the diamond towards the wheel. Maximum adjustment which can be obtained by turning the graduated dial is $\frac{1}{2}$", each space being equivalent to .001". Either a perfect cylinder or a wheel with concave face is generated by this truing device.

The standard regulating wheel truing attachment trues the wheel only for straight cylindrical work. If other shapes must be ground, a similar attachment known as the Profile Truing Device, may be obtained to true the wheel to the shape of the work. When the machine is so equipped, and with a straight cam in the truing device, the following tapers can be trued on the wheel:

6" face wheel, 8° taper
2" face wheel, 2° taper
8" face wheel, 6° taper

Generally speaking, the function of the standard regulating wheel truing device is to make the diamond follow the same line of contact with the wheel as that followed by the work. In other words, the regulating wheel must be trued so that the work, while passing between the wheels, makes contact with the entire width of the wheel face. To obtain this condition, three factors must be taken into consideration.

[24]

The second factor is fixed by the fact, that is, the truing fixture must be rotated about its trunion "O" an angle equal to the angle of inclination of the regulating wheel spindle. For example, suppose that the rear end of the spindle is depressed 5° below the horizontal. Then the truing fixture must be swiveled 5° in a clockwise direction (considering the plan view Figure 19).

The third factor is fixed by the diameter of the work. Suppose that the correct line of contact between the work and the wheel is $\frac{1}{4}$" above the center of the wheels. Then diamond holder "G" must be moved approximately $\frac{1}{4}$" in the direction indicated by the arrow. (To the right when viewed from the wheel end of the spindle). Conversely, if the center-line of the work is below the center of the wheels, the diamond must be moved to the left by the same amount.

More precise results may be obtained by calculating the theoretically correct setover of the regulating wheel truing diamond. Use the following formula: (See Figure 20.)

$$\text{Setover} = \frac{DH}{D + d}$$

D = Diameter of regulating wheel
d = Work diameter
H = Height of work center above center of wheels

Figure 20

Note—Use the highest regulating wheel speed available when truing.

Multiple diameter work can be ground by the infeed method if the differences in diameter are not too great. To true the wheel, mark the slide to indicate the length of each ground diameter, and adjust the dial to displace the diamond an amount equal to the radial difference between the ground surfaces.

[25]

GRINDERS INCORPORATED

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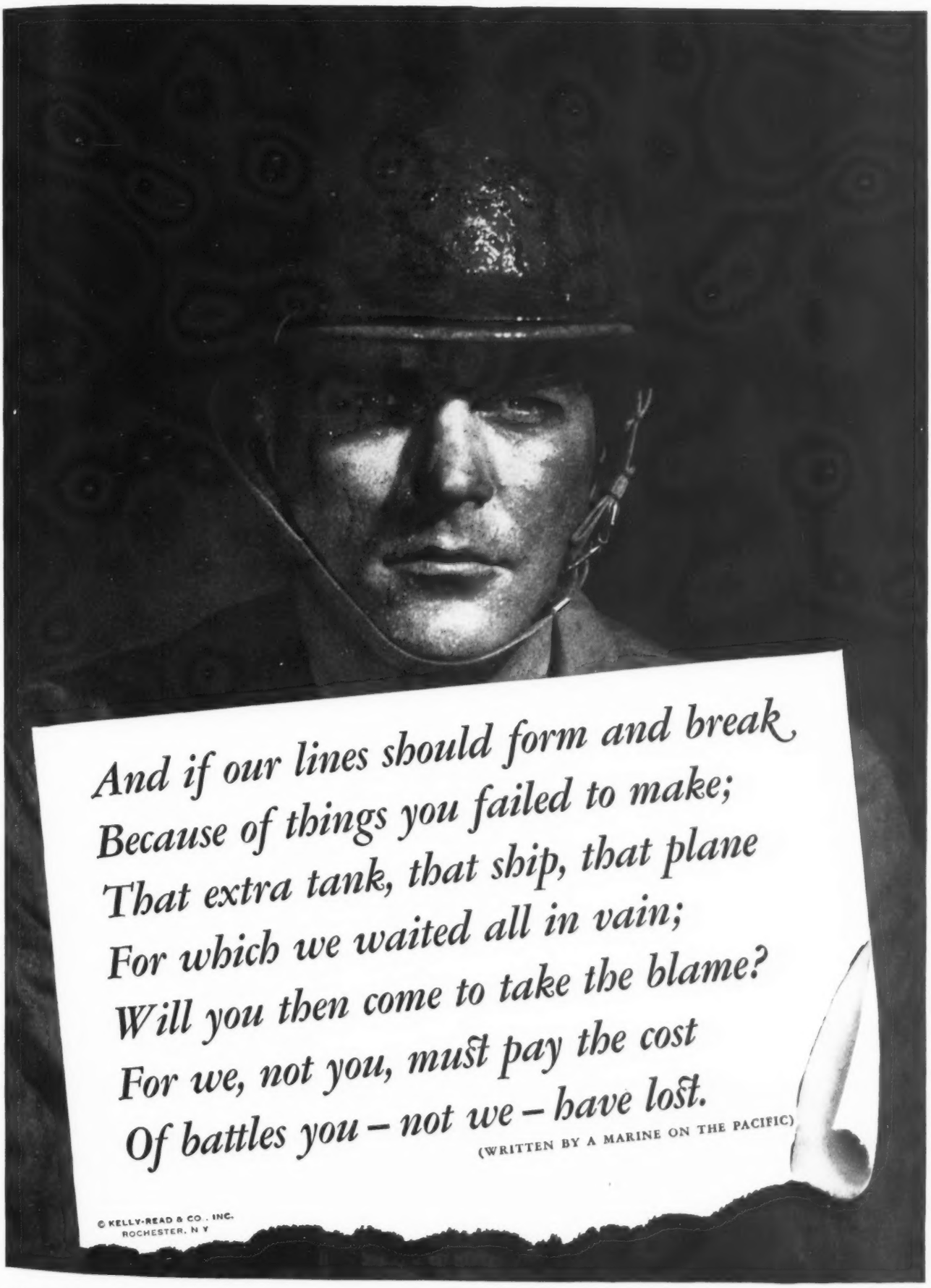
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

The message on the facing page is one of the most stirring pieces of writing which World War II has produced to date. Much has been said and printed about what we at home must do to help America's soldiers win this war. From the point of sound judgment as well as fine writing, we believe this poem outranks any other exhortation to the American people for more production.

VAN NORMAN MACHINE TOOL COMPANY

Springfield, Massachusetts


And if our lines should form and break
Because of things you failed to make;
That extra tank, that ship, that plane
For which we waited all in vain;
Will you then come to take the blame?
For we, not you, must pay the cost
Of battles you – not we – have lost.
(WRITTEN BY A MARINE ON THE PACIFIC)
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If you would like copies of this epic poem in poster size we shall be glad to supply them without charge

To Finish The Job Quicker . . .

CONSIDER THE SHOULDER

The story here has to do with the side of the grinding wheel at work, rather than the face. On any precision grinding machine, the side of the wheel may be utilized, but the speed and efficiency of such operations may be immensely improved if the Landis shoulder grinding attachment is employed.

A quick picture of the appearance of the attachment and what it will do may be gained by following through the series of views on these two pages. Beginning in the upper left-hand corner, the illustrations show:

N-66—The Landis shoulder grinding attachment used in connection with crank grinders and the heavier plain machines. A handwheel convenient to the operator permits smooth, easy lateral feeding of the wheel as required.

C-52—Grinding a flange of a radial crankshaft section on a Landis 25" Type D Radial Crank Grinder.

N-59—Grinding the pins and adjoining flanges of a long in-line crankshaft on a Landis 25" x 96" Type DD Hydraulic Crank Grinder.

J-186—The Landis shoulder grinding attachment used in connection with the universals and smaller plain machines. A convenient lever moves the wheel laterally, while an indicator shows the amount of movement.

J-159—Grinding grooves accurately to width on a Landis 12" x 72" Type C Hydraulic Universal. Work is located laterally in exact relation to the wheel by means of the indicator shown.

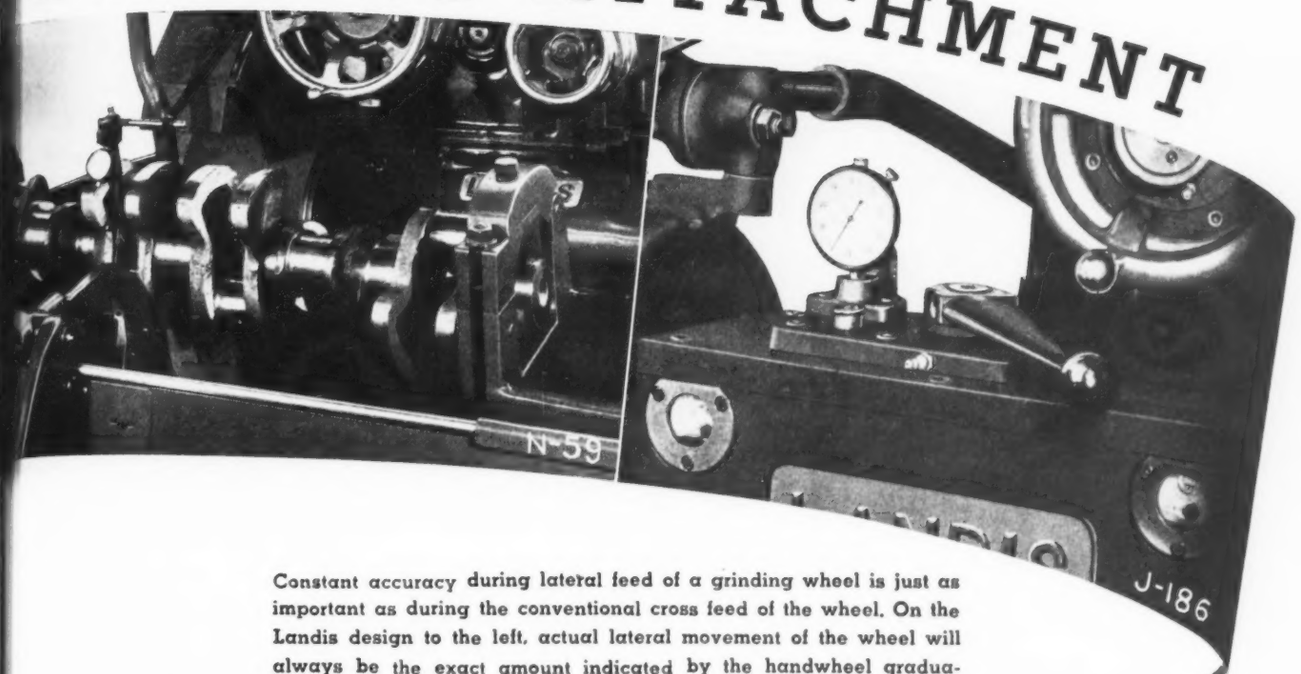
J-187—Grinding the shoulders of a small high speed spindle where the relationship between the two ground surfaces must be maintained within an exceedingly close limit. The machine used is a 14" x 36" Type C Hydraulic Universal.

Landis engineers have had considerable experience in the application of the shoulder grinding attachment and would like to share this experience with you. They will do this gladly once they are familiar with the problems you are facing.

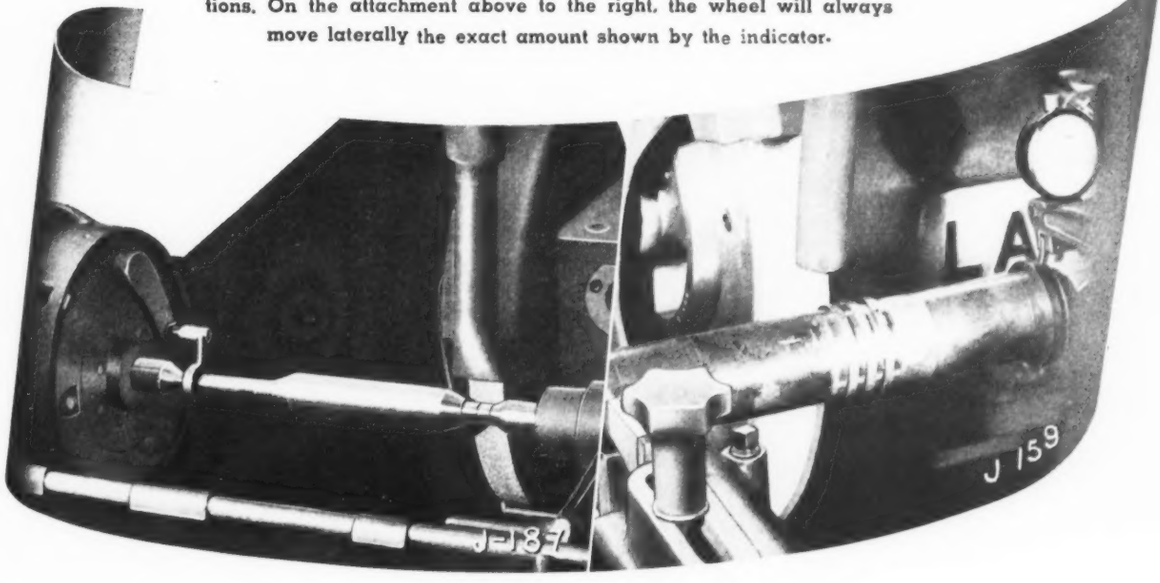
Unusual Performance as Usual

PRECISION LANDIS GRINDERS

GRINDING ATTACHMENT



Constant accuracy during lateral feed of a grinding wheel is just as important as during the conventional cross feed of the wheel. On the Landis design to the left, actual lateral movement of the wheel will always be the exact amount indicated by the handwheel graduations. On the attachment above to the right, the wheel will always move laterally the exact amount shown by the indicator.



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LANDIS
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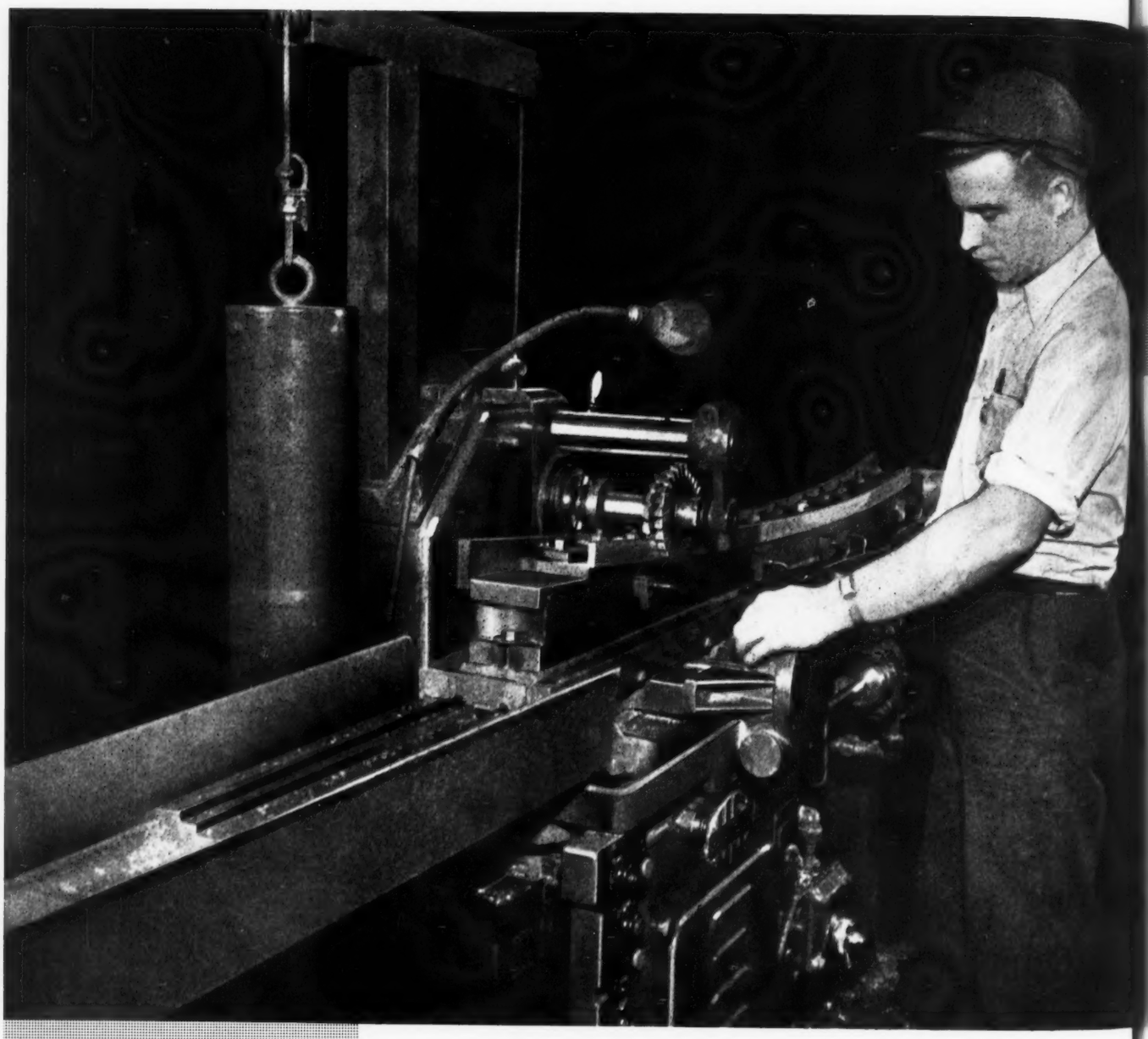

The U. S. Multi-Miller in action in one of the world's largest aircraft plants, applied to the milling of splice plates. The cutter arbor is raised and lowered automatically as the table action feeds the work longitudinally.

INDEX MILLING—GRINDING—VERTICAL MILLING—SPUR GEAR CUTTING—AUTOMATIC CUT OFF—CONTINUOUS MILLING OF BAR AND COIL STOCK—ROTARY MILLING—CONTOUR MILLING—CLIMB MILLING—BLIND MILLING

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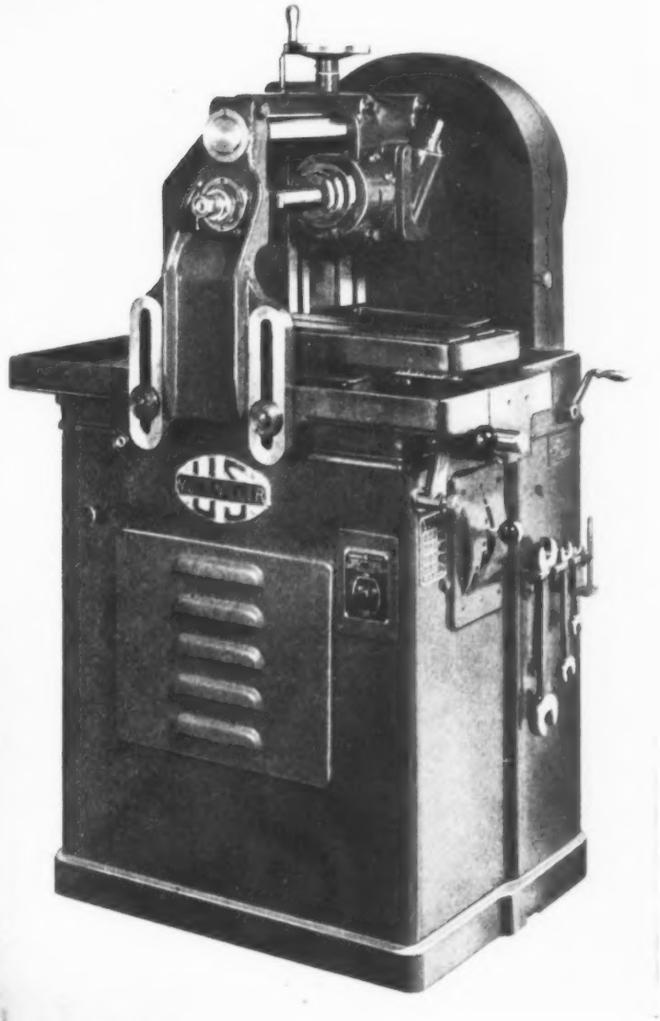
In the photograph on the opposite page, a special application of a U. S. Multi-Miller is pictured in operation at one of the world's largest aircraft plants. This special application emphasizes the versatility of the U. S. Multi-Millers. U. S. Tool Co., Inc., Ampere (East Orange), New Jersey.



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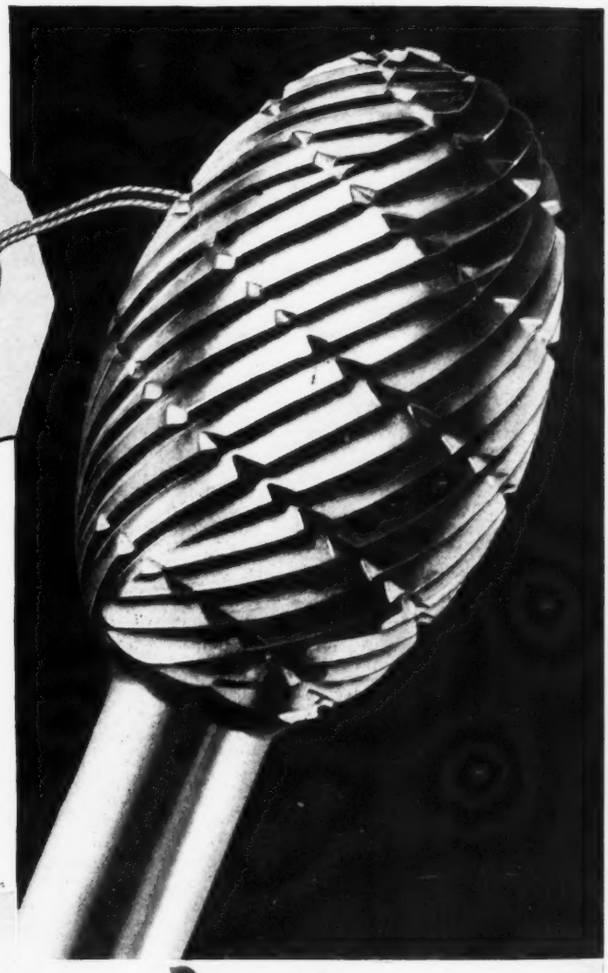

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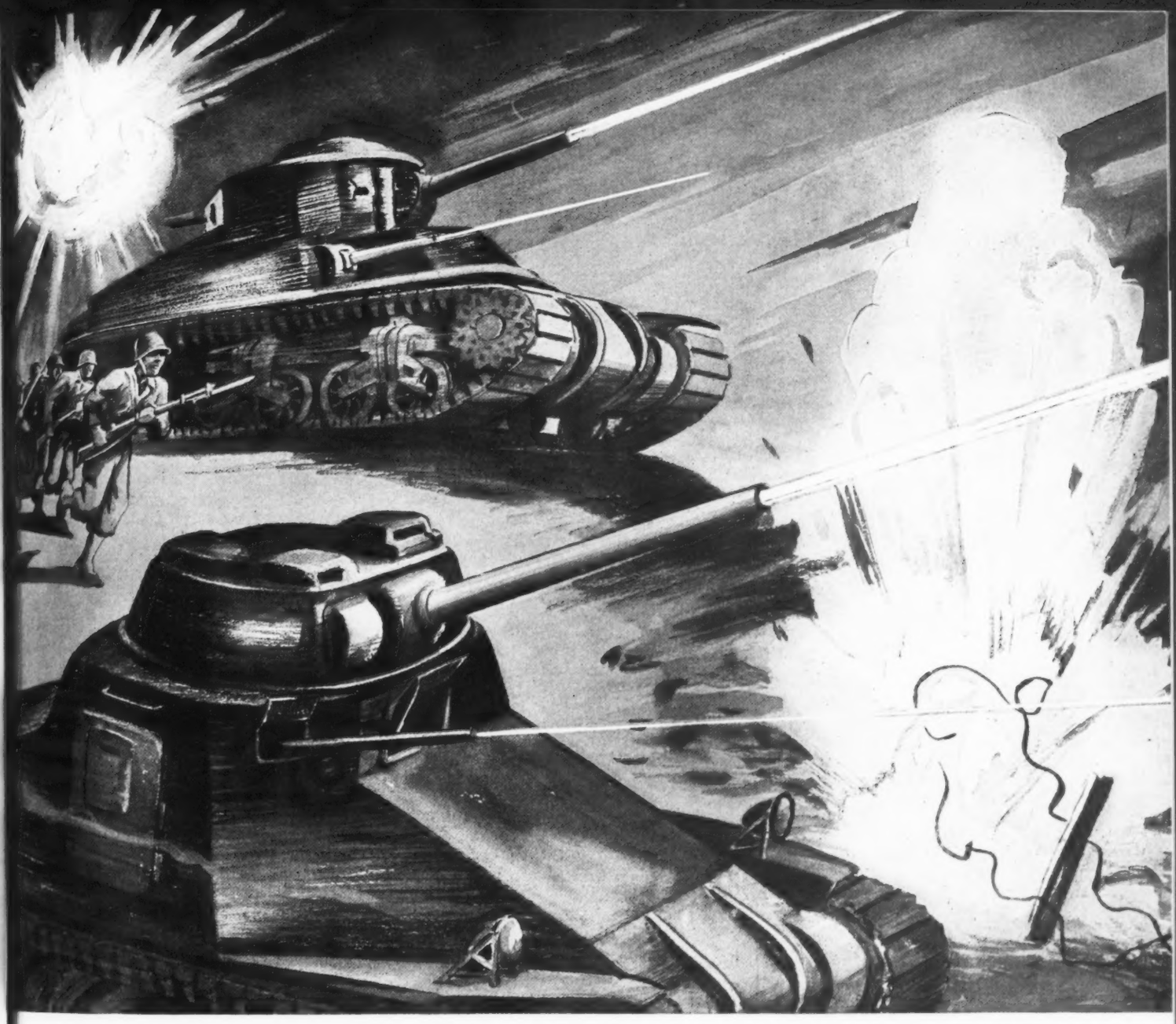

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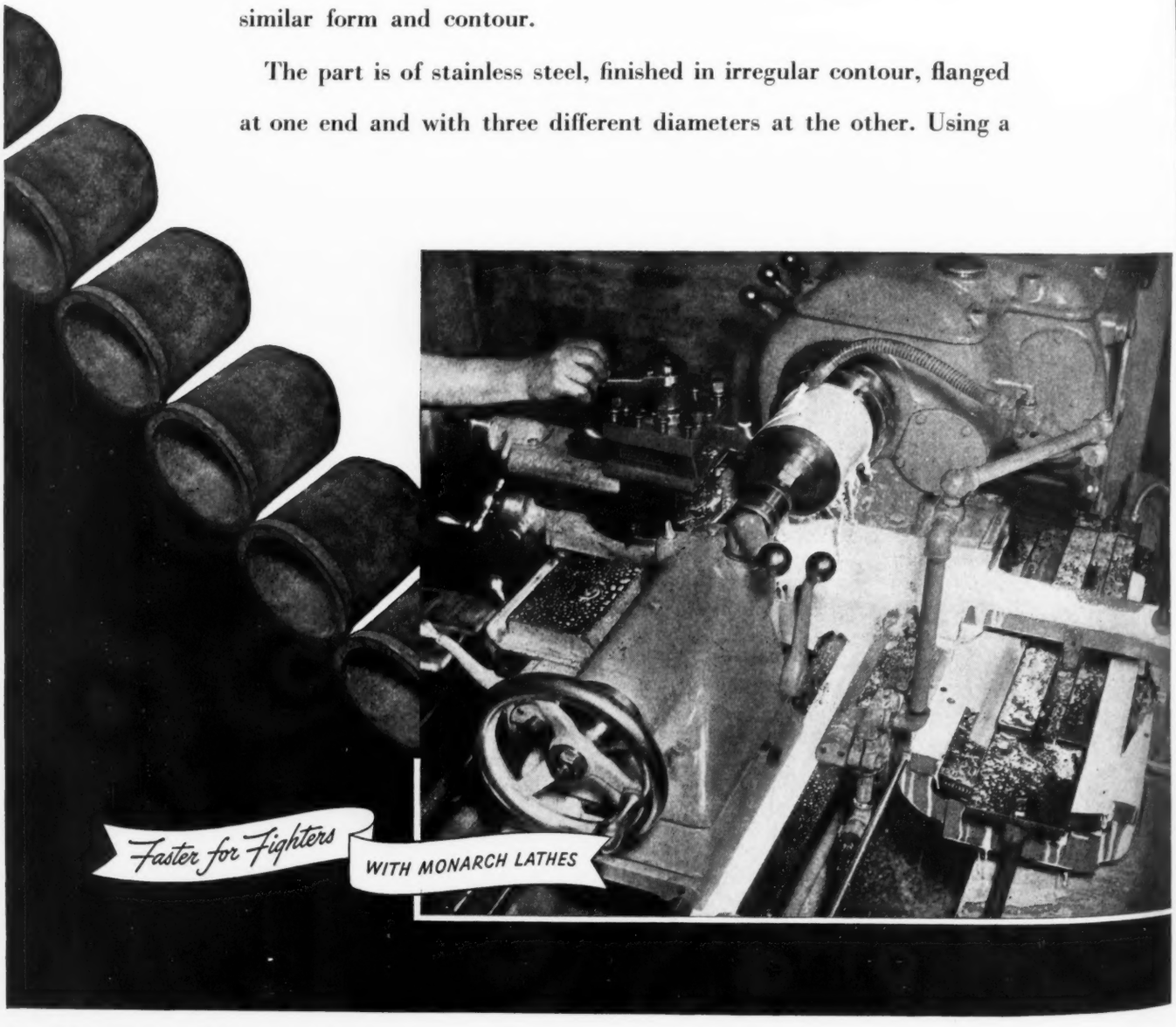

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Monarch Lathe equipped with mechanical profile or forming attachment, the job is finish-turned completely in one setup. A double track cam guides the roller follower and reproduces the form on the work. Accuracy of form, providing perfect interchangeability of cylinders, is a basic requirement. This is being accomplished on a production basis with this Monarch equipment.

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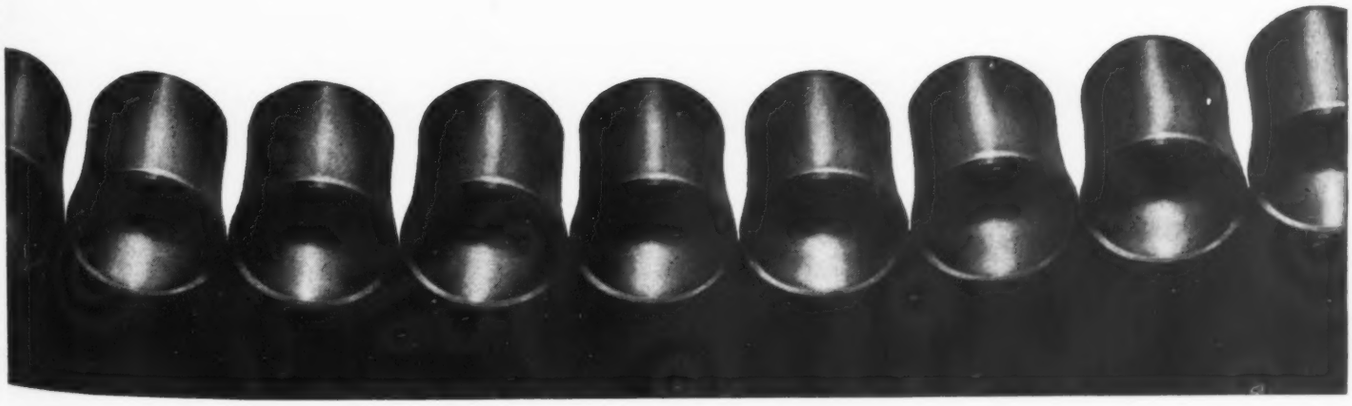
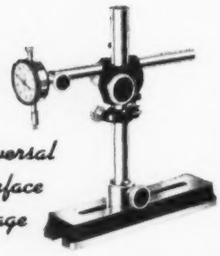


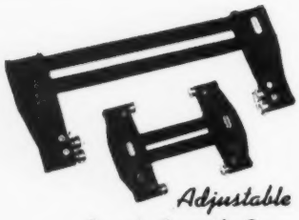
STANDARD Gages

Dial Bore Gage

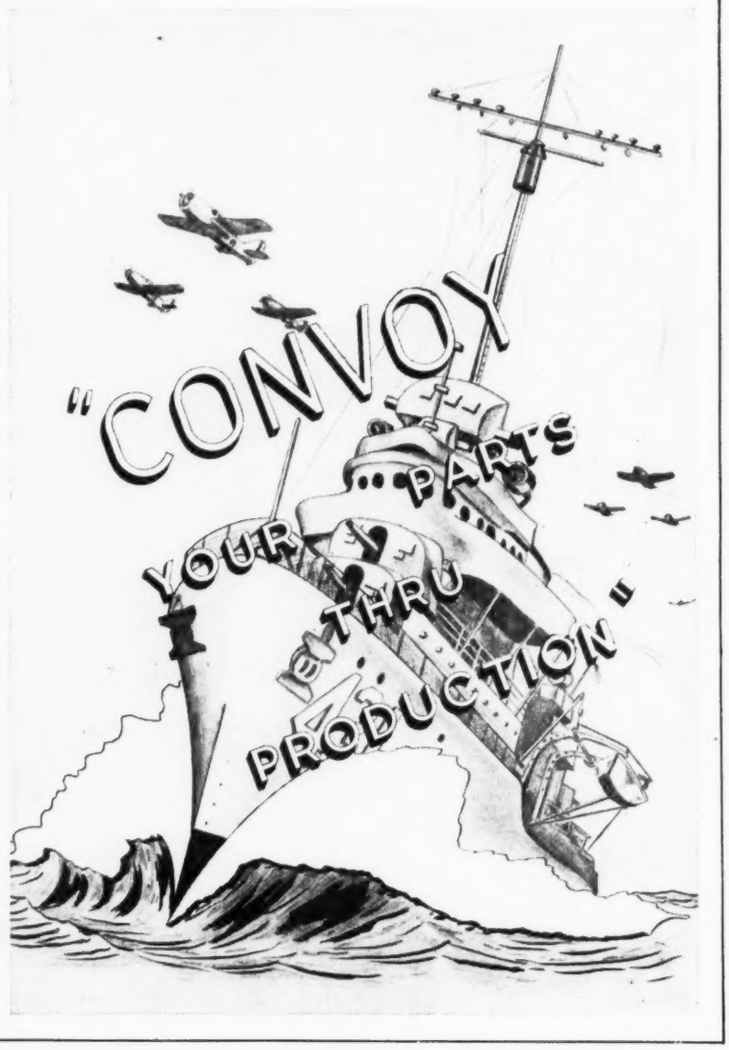
Snap Gage



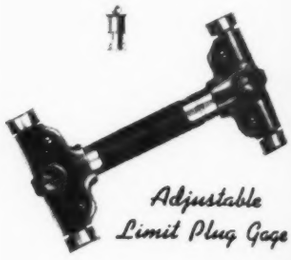
Universal Surface Gage



Adjustable Limit Length Gage



Test Indicator



Adjustable Limit Plug Gage

Cylindrical Ring Gage

Depth Gage

Dial Pin Gage

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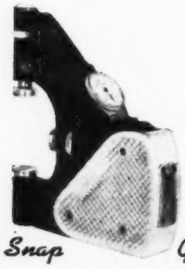
Dial Indicator

Dial Plug Gage

Cylindrical Plug Gage



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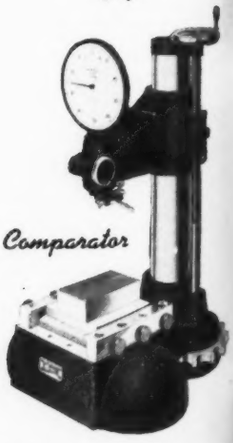

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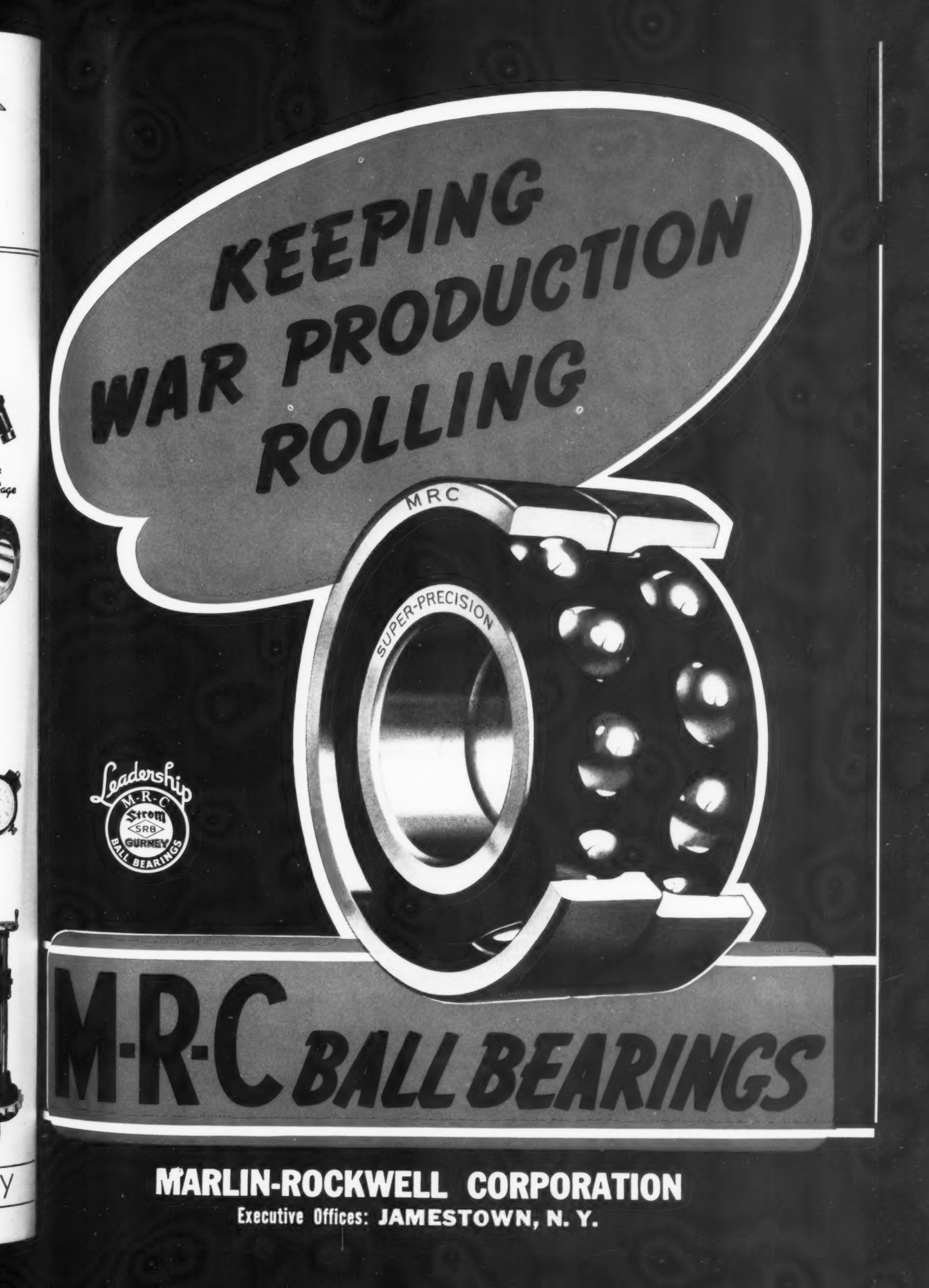
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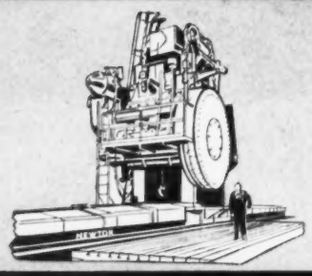

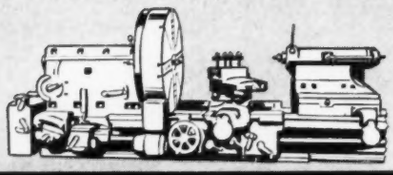

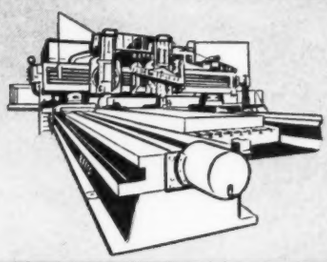

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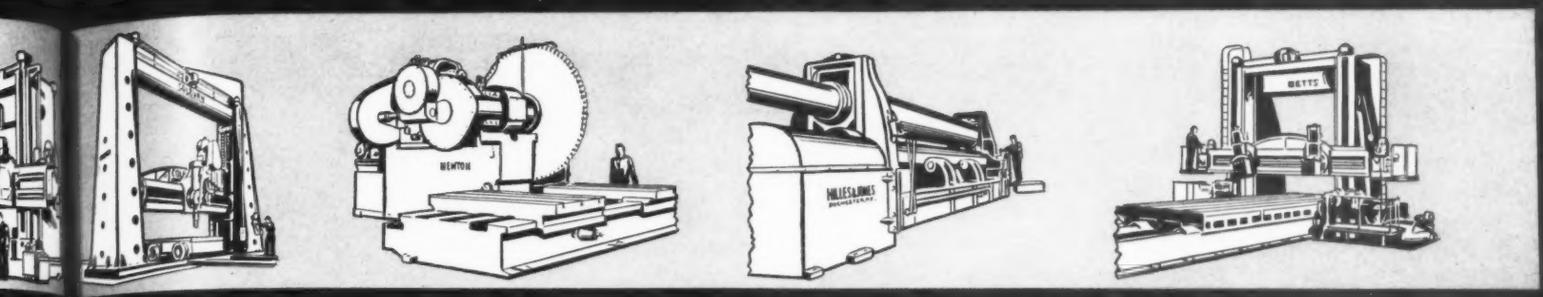

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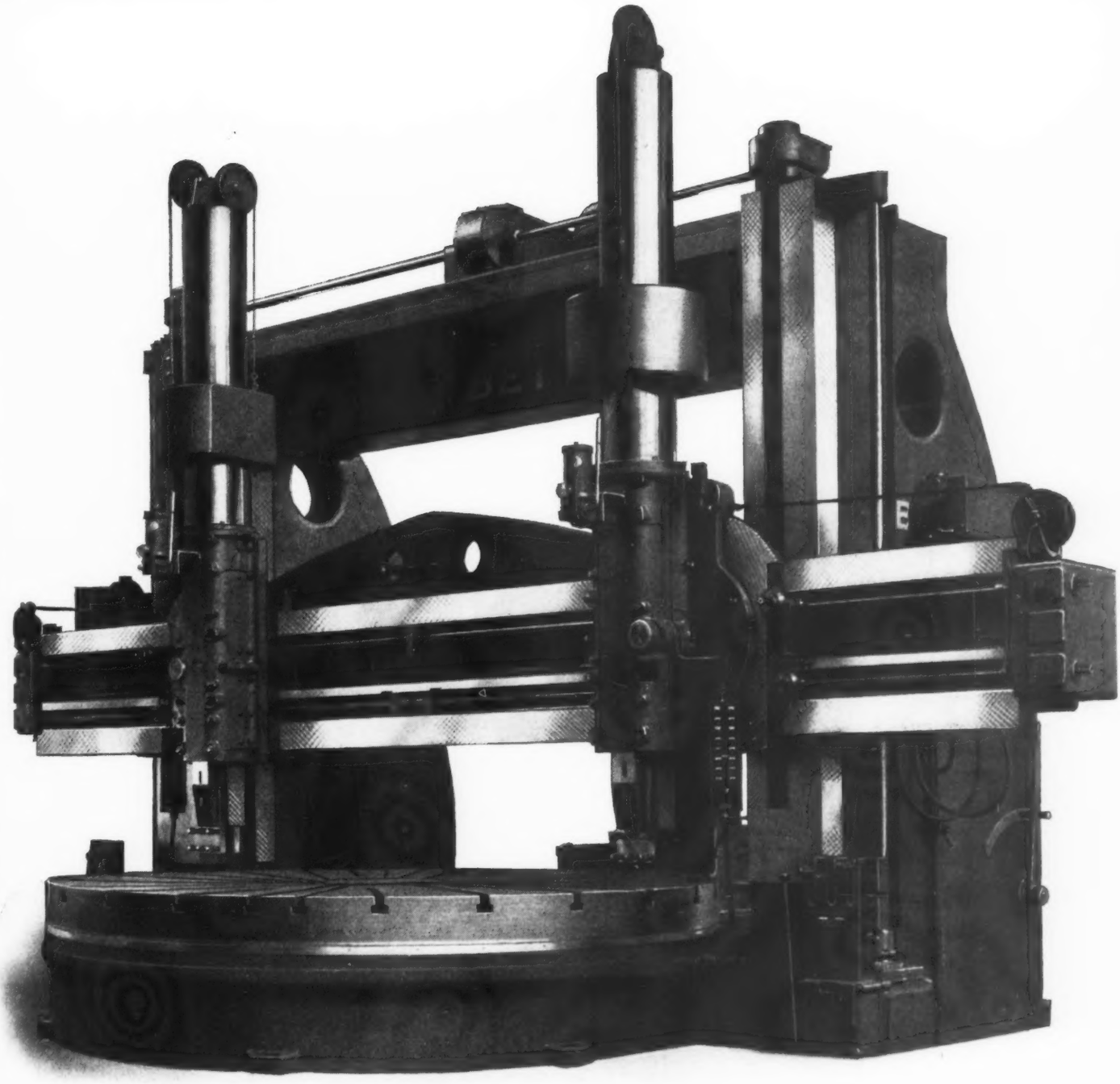

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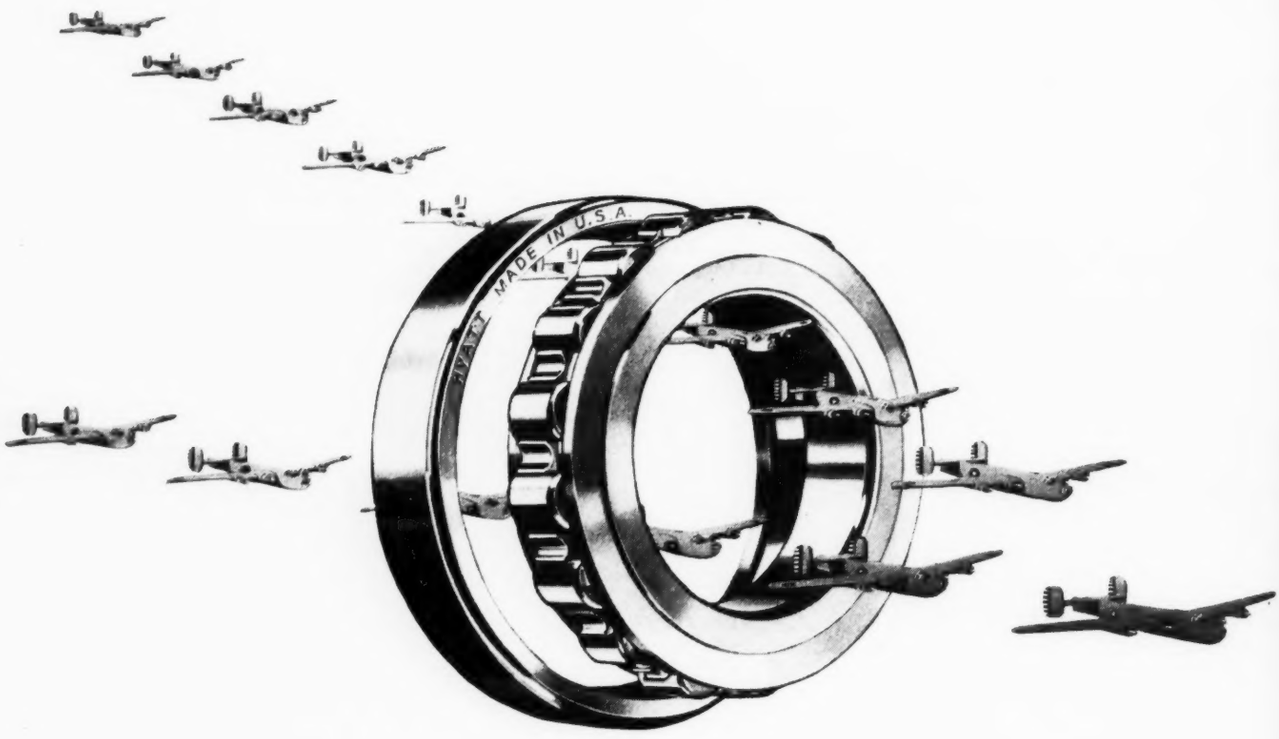
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK



High Precision

The enormous striking power of America's eager, fighting planes comes largely from the amazing accuracy of their hundreds of precision parts.

Prominent among these parts are the smooth rolling Hyatt bearings into which we build great capacity while holding them true to required precision tolerances.

Ranging from hyper-quality large engine crankshaft bearings to relatively smaller super-smooth bearings for superchargers, Hyatt precision products faithfully serve the nation through the aircraft industry.

But, aviation is not the only field in which Hyatt Roller Bearings are battling the Axis.

Their proved performance under battle conditions in tanks, guns, ships and trucks . . . their round-the-clock operation in factories, on farms and railways . . . all reflect the many advantages of their high precision manufacture.

Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

HOWARD foremost in Magnesium Castings

The new Howard magnesium foundry has a capacity of over 500,000 pounds of castings per month. Its output during the next few months will exceed the entire volume of magnesium produced in the United States in 1938. This plant supplements the two Howard foundries where aluminum and copper-base castings are produced. This combination of facilities affords the largest production of non-ferrous castings in America.

Lightest of structural metals—two-thirds the specific gravity of aluminum—magnesium possesses the highest ratio of strength of all metals, is the easiest to machine and has high resistance to impact.

Howard magnesium castings are proving their worth in machinery and tools as well as fighting equipment; planes, guns, tanks, ships and military vehicles. One application on a four-motor bomber saves the weight of two men, as compared with the part formerly used.

The war work at the Howard foundries is revealing many civilian uses for cast magnesium parts. Some of these may effect improvements in your products. A booklet, "Non-ferrous Castings and Their Uses," awaits your request.

HOWARD FOUNDRY COMPANY
4900 Bloomingdale Road
CHICAGO, ILLINOIS

ARMY E NAVY

HOWARD

ALUMINUM · BRASS · BRONZE · MAGNESIUM

CASTINGS

. . But his customer got the Gauges in time!

Recently a Purchasing Agent handed a Distributor's salesman an order for a set of Gauges—normally a stock item with any well-equipped Jobber.

But the local factories are loaded up with precision work—first it seemed Gauges would be hard to find, finally the salesman admitted none were to be had.

"We haven't quit trying," he reminded the P. A.—from his own office he called a responsible manufacturer 600 miles away. "Yes," replied the Gauge man, "we have some of those sizes and will ship today."

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

When the Distributor billed the job, he added $6.00 normal gross profit. Then he paid the Telephone Company a $4.00 toll, leaving $2.00 for himself. Still he feels he is away ahead because one of his standard policies is to say "thanks—sure we'll take care of you on every order."

You like to do business with firms like that and so do we. Years ago we began appointing them *our* Distributors—and *your* close-at-hand source of supply for Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

ARMY NAVY

Awarded May 22, 1942
Superseded July 13, 1942

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST., E.C.4

ARMY E NAVY

Awarded August 8, 1942
★

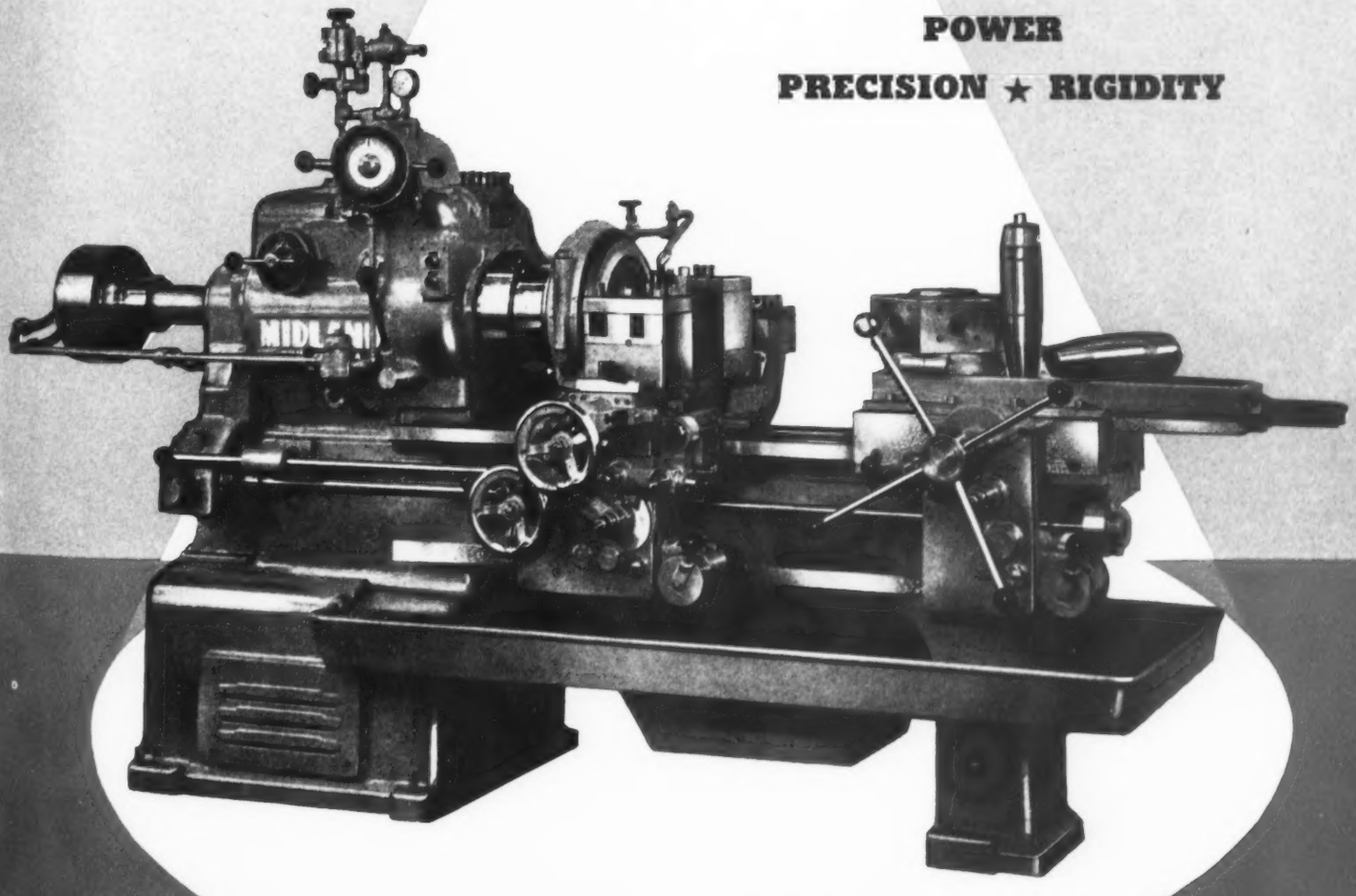
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Midland

High speed, highly accurate wartime production requirements are adequately fulfilled on the Midland Universal Ram Type Turret Lathe. All exacting requirements for precision are met with assurance, due to the extreme rigidity of this heavy duty Lathe. This feature, coupled with hardened steel ways, assures enduring accuracy under high speed, heavy duty action. Convenience of operation permits maximum output, even by inexperienced operators—as indicated by the accompanying illustration of 90 mm. high explosive shells. Note anti-friction steadyrest, a Midland feature for extra rigidity and support to overhang of collet chuck. Full particulars upon request.

POWER

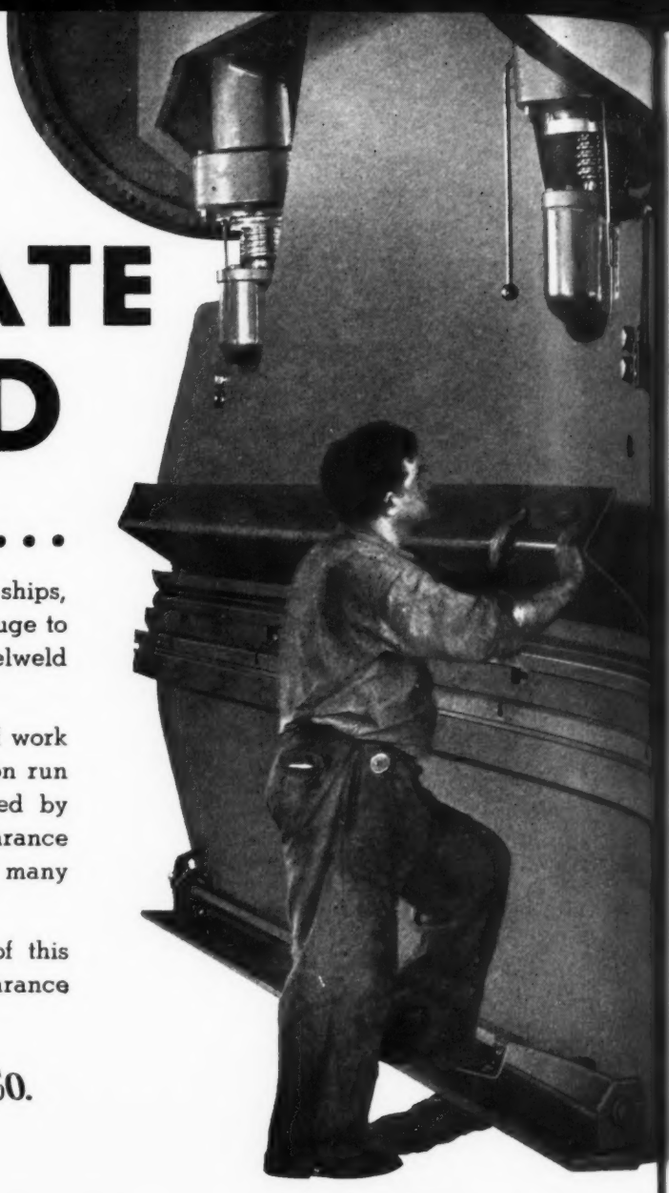
PRECISION ★ RIGIDITY



EARLY DELIVERIES on Priority Orders

Write to Midland Machine Corp., 515 W. 35th St., Chicago

WHERE PLATE IS WELDED



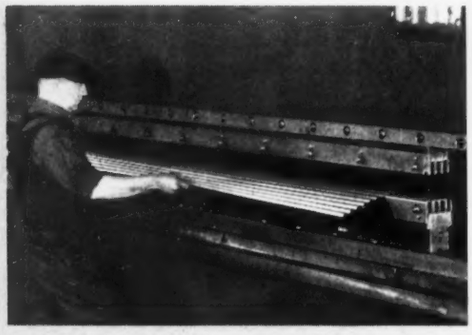
A STEELWELD IS NEEDED . . .

Whether you make army tanks, boilers, railroad cars, ships, machinery or airplanes, if you work with metal from 12 gauge to one inch thick, most likely you have great need for a Steelweld Bending Press.

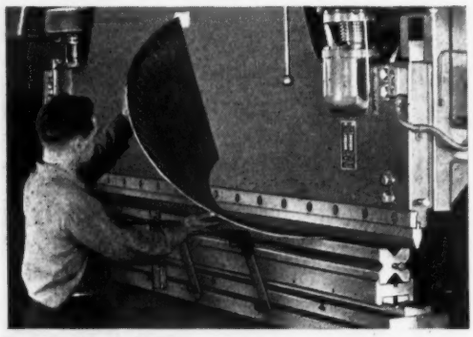
Steelwelds are versatile tools that perform many types of work quickly and easily, whether only one piece or a production run is required. Long, sharp welded corners can be replaced by quickly made, smooth, round, bended ones, and both appearance and strength improved. Illustrated below are some of the many kinds of work that can be performed on any Steelweld.

It will pay you to investigate the many possibilities of this modern metal-forming tool that is improving product appearance and saving time and money for many enthusiastic users.

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1157 EAST 283RD STREET • WICKLIFFE, OHIO.



Corrugating and any straight-line production bending can be done to hairline accuracy.



Conical sections are quickly formed with standard bending dies by use of the ram-tapering mechanism.

Dozens of Steelwelds, same as used for peacetime work, are straightening heat-treated armor plate in thicknesses up to 3 inches.

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

GET THIS BOOK!

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

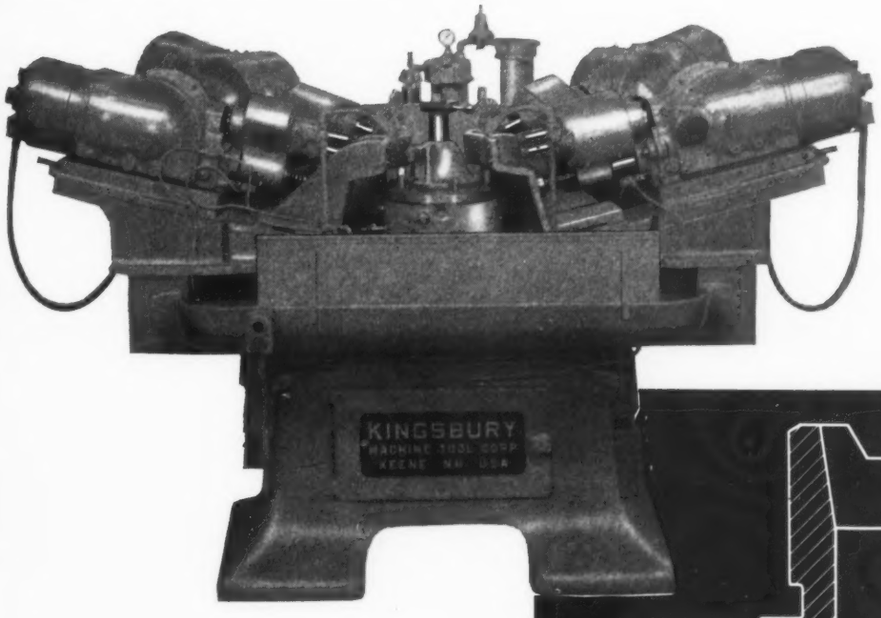
GENERAL SALES AGENTS: CYRIL BATH & CO., E. 70TH & MACHINERY AVE., CLEVELAND

FLEXIMATIC *by Kingsbury*

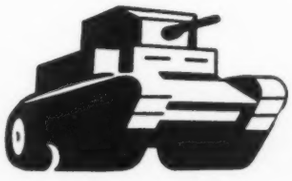
In every branch of war production, on hundreds of parts large and small, Kingsbury **FLEXIMATICS** are combining and simplifying operations, making mass-production speeds possible on even the most intricate jobs. The job shown requires the drilling and spotfacing of 40 holes in brake shoes for tanks. For this operation, an 8-spindle Fleximatic was designed. The operator merely clamps the work in the fixture and trips the machine, whereupon all the operations are performed automatically and the machine automatically stops.

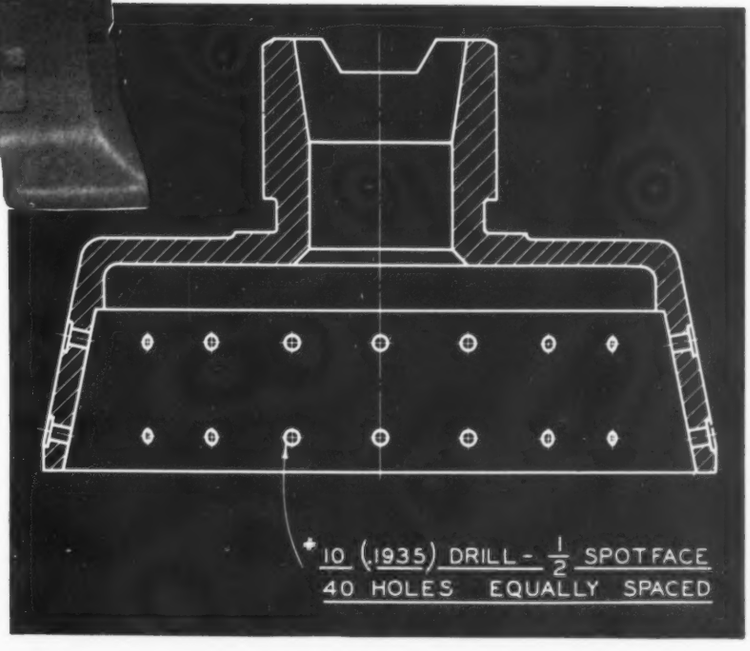
Replacing a number of machines, requiring a minimum of attention, and capable of being operated by semi-skilled labor, Kingsbury **FLEXIMATICS** are solving the time, floor space and labor problems of many war production industries.

DRILLS AND SPOTFACES 40 HOLES IN ONE CHUCKING!



THIS IS A *Fleximatic* **JOB!**





"AMERICAN"

FOR ALL-OUT PRODUCTION

HOLE WIZARDS ARE MEETING THE CHALLENGE

"American" Hole Wizards are meeting the 24 hour production challenge of our shipbuilding schedule without a whimper. Day in and day out in our Navy Yards and Shipbuilding plants they are drilling, boring and tapping at top speed and at the same time maintaining amazing standards of accuracy.

Shipbuilding plants that have established records for launchings are using "American" Radials.

THE AMERICAN TOOL WORKS CO.

CINCINNATI, OHIO, U.S.A.

LATHES RADIALS SHAPERS

"AMERICAN" *Hole Wizard* RADIALS

Where STANICUT OILS Are Used

anicut 107 BC is designed high speed automatic work free cutting steels and can be ed on copper and brass, with- t danger of staining the work. is also suitable as a coolant here carbide alloy tools are ed.

★

anicut 62 FC gives consid- ably better tool life and finish an kerosene and lard oil nds commonly used for ma- ining tough aluminum alloys. contains no active sulfur and be used for machining cop- and brass. This eliminates anging oil when both alumi- m and copper are worked on same machine. The higher sh point decreases the fire zard.

★

anicut 155 SC is giving ex- lent results on the tougher oy steels, especially those t tend to "smear" and leave oor finish with ordinary cut- g oils.

★

nicut 126 BCS was devel- d for machining 1335 and ilar steels lower in machin- ity rating than free cutting w stocks, and it gives ex- ent tool life.

★

nicut 309 BCS is designed heavy broaching, threading tapping soft steels or those ich tend to tear easily. This is high in active sulfur, con- s compounding, and acts as anti-flux as well as a coolant.

★

WAR-PRODUCED FOR WAR PRODUCTION

NEW STANICUT OILS

One of these cutting oils can do one or more of your jobs better

● STANICUT OILS are distinctly a war-born development. They are designed to help tools and machines meet the rigid requirements for accuracy and finish at the higher speeds and on the new alloy metals in use today.

Standard Cutting Oil Engineers have spent months in developing, testing and applying them to some of the toughest jobs in war-plant work. If you are still finding it difficult to get the necessary accuracy, finish, and tool life call in one of these cutting oil specialists. See if one of these new oils—and the Engineers' experience in applying them—can help you.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

2 typical Stanicut applications

Threading M130 Bomb Fuses—Before Stanicut 126 BCS was used in threading WD1314 steel bomb fuses, thread chasers had to be ground every 500 to 1000 pieces. With Stanicut, 6000 pieces are threaded before regrinding the chasers. Thread quality was also improved.

Machining Aluminum Fuse Adapter—On an automatic operation, tough aluminum-alloy parts are formed, drilled, counterbored, chamfered, and cut off at the rate of one each 10 seconds. Even at this high speed, parts run cool with Stanicut No. 62 FC. Finish and tool life are good. Decreased carryaway on parts and chips has reduced oil consumption one-third.

STANDARD OIL COMPANY (INDIANA)

•LUBRICATION ENGINEERING••LUBRICATION ENGINEERING••LUBRICATION ENGINEERING••LUBRICATION

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STANICOOL H.D.
SOLUBLE OIL

A new type of cutting fluid for the in-between jobs

● On some operations, and with some metals, such as stainless steel, it is difficult to get good tool life and finish with a conventional water emulsion; yet a cutting oil will not supply sufficient cooling to prevent overheating of the work and tool.

Standard Oil Engineers started months ago to work on this problem. Oils were developed and tested on some of the more difficult jobs as they came up in plants converted to war work. Out of this a new type of cutting fluid was developed—STANICOOL HEAVY DUTY SOLUBLE OIL—that has the cooling quality of an emulsified oil, and the ability to give tool life and finish approaching that of a cutting oil.

This oil can't replace all cutting oils, but it may be the solution to some of your troublesome "in-between" machining jobs. Call in a Standard Cutting Oil Specialist and see.

Why experiment with cutting oils? See a Standard Cutting Oil Engineer

You'll save *your* time, machine, and operator time by getting the answer to your metal cutting problems sooner through the help of a Standard Cutting Oil Engineer. These men have been working on problems just like yours since the first plants converted to war production. They've helped in the development of new products and new applications of their old line products for machining the new steels and alloys in use today.

You can also get the help of the Research and Technical Departments of Standard Oil through one of these Engineers. It is not unusual today to find that no available cutting fluid exactly meets the requirements on a machining job. Where you have this problem the Engineer can relay the details of it to his Technical Department. There, special recommendations can be made to meet your need.

Call in a Standard Cutting Oil Engineer. His recommendation may save you many days time experimenting with various mixes and types of cutting fluids.

Keep motors on the job with STANODRIP

Do you have motors in your plant that are always in trouble—bearings over-heating—windings become oil soaked—motors that require constant watching and frequent cleaning?

When spare motors and time were plentiful, you could take these trouble-makers off the job and try to correct their faults. But there's neither time nor motors to spare today. Yet that doesn't mean that you have to nurse these troubles for the duration.

Here's what you do. Where you have a motor that seems to be using a lot of oil, or where oil is creeping along the shaft and getting into the windings, test Stanodrip on it. It's designed for just such hard-to-lubricate jobs. Here's an example:

The motor on the blower pictured above was being oiled twice a week, it required frequent cleaning, and was overheated continuously. After a thorough cleaning, Stanodrip No. 39 was put in the bearings. Now, oil cups are filled once every three or four weeks. Dirty windings are practically eliminated, reducing maintenance cost by about 50% on this motor. Best of all, the operator has quit worrying about failures from overheating.

Have a Standard Lubrication Engineer choose the grade of Stanodrip you need for the job you pick.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA
SOUTH DAKOTA • WISCONSIN • WYOMING

OIL IS AMMUNITION...USE IT WISELY

STANDARD OIL COMPANY (INDIAN

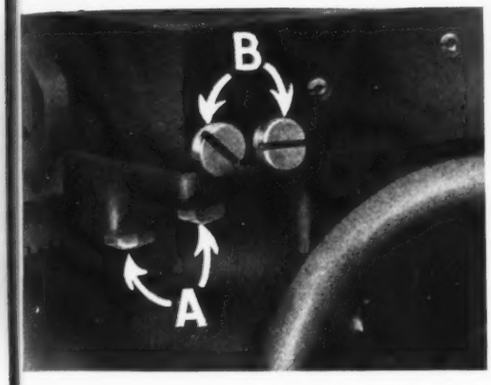
I'm Tellin' You..

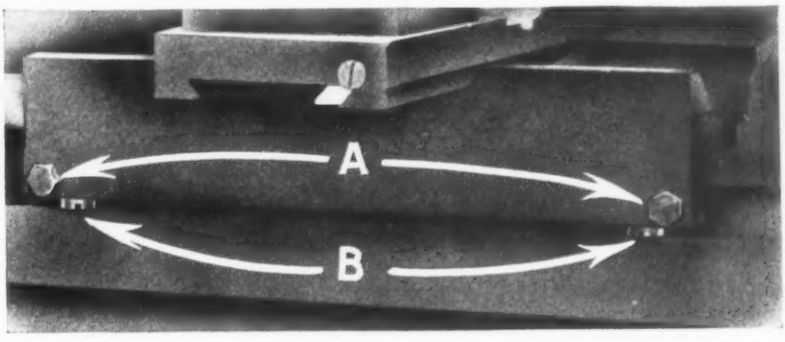
No. 6 in a series of tips on "Keeping 'em Turning" by Charley Wetterer, 43 years at LeBlond.

"Clean your teeth twice a day and see your dentist twice a year" is a pretty good general rule. Lathe care would be a lot simpler if we could set up some kind of slogan like that for adjustments. But the schedule for lathe adjustment varies greatly with the number of work hours per day, the kind of material machined, regular or intermittent cut, condition of tools used, etc.

However, chatter in the work is a pretty fair sign that adjustments may be needed. The most common source of this kind of trouble is slack in the bearings at these two points. Both are easily fixed.

ADJUSTING CARRIAGE GIBS





Each of the two front gibs on the carriage have a bearing on the side of the Veeway and are held in position by the two cap screws (A). Two adjusting set screws (B) hold the carriage gib firm against the side of the ways. To take up slack caused by wear on the bearings, loosen bottom screws (A), then tighten side screws (B) until you feel slight pressure of gib against the way. Now retighten bottom cap screws.

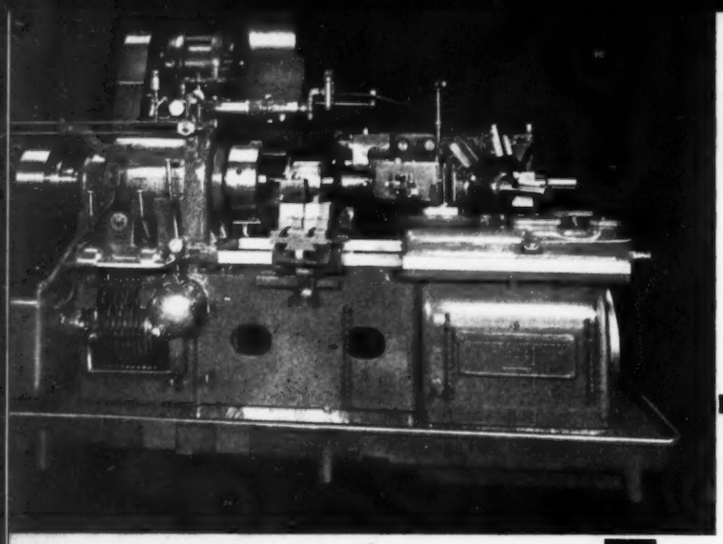
On the long gib in the rear of the carriage which does most of the work, the position of the cap and adjusting screws (B) are on the bottom. However, the procedure in relation to cap and adjusting screws is the same, i. e., loosen (A), tighten (B), then retighten (A).

ADJUSTING SPINDLE

Wear in anti-friction bearings of the spindle is another cause of vibration of the work on old lathes. Here the adjustment procedure itself is simple, but is different for each type of lathe. For information on eliminating end play or longitudinal movement in your particular lathe, write me for easy instructions.

ARMY E NAVY

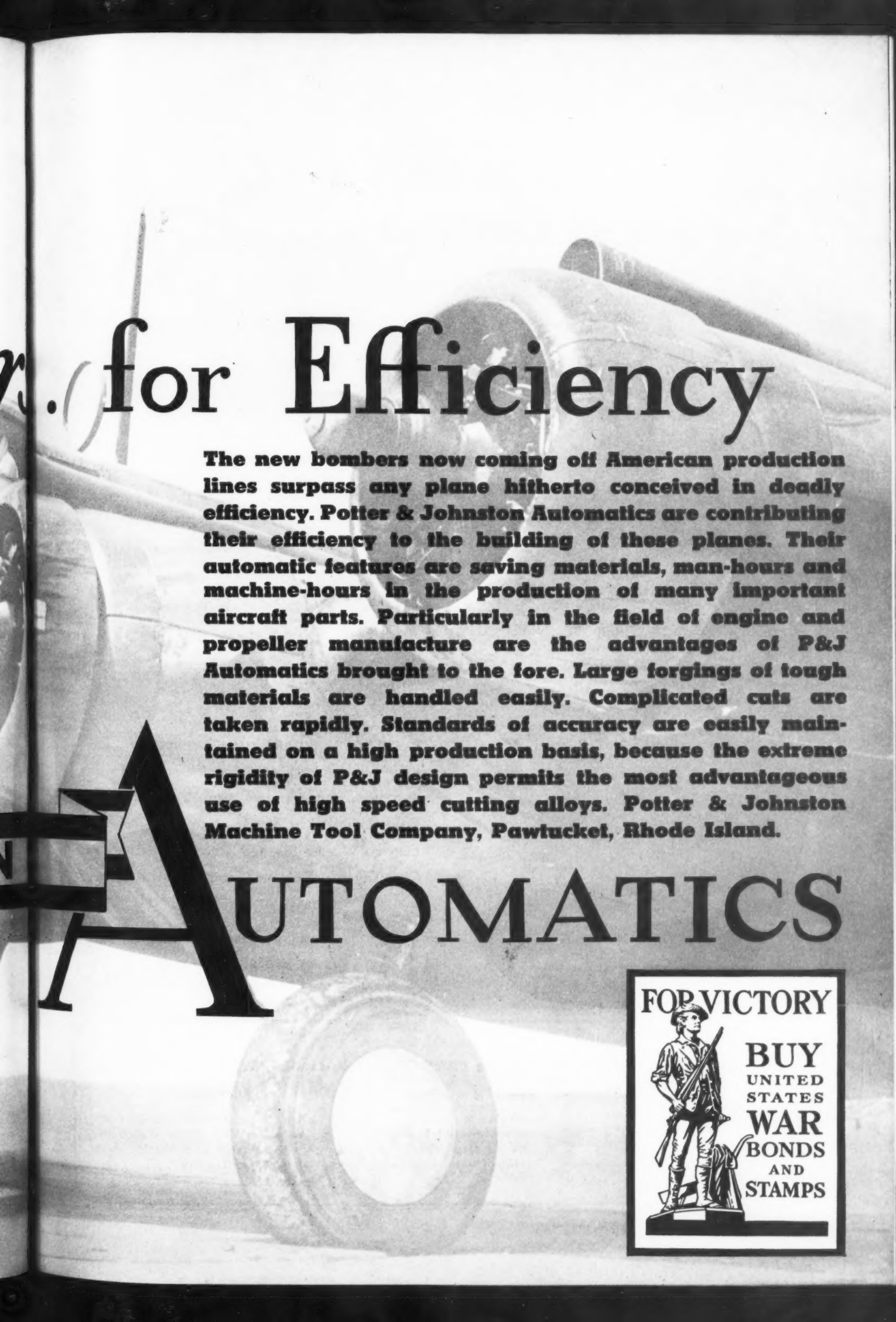
THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati, Ohio
Largest Manufacturer of a Complete Line of Lathes



Partner...

P&J POTTER and JOHNSTON

OFFICIAL OWI PHOTO



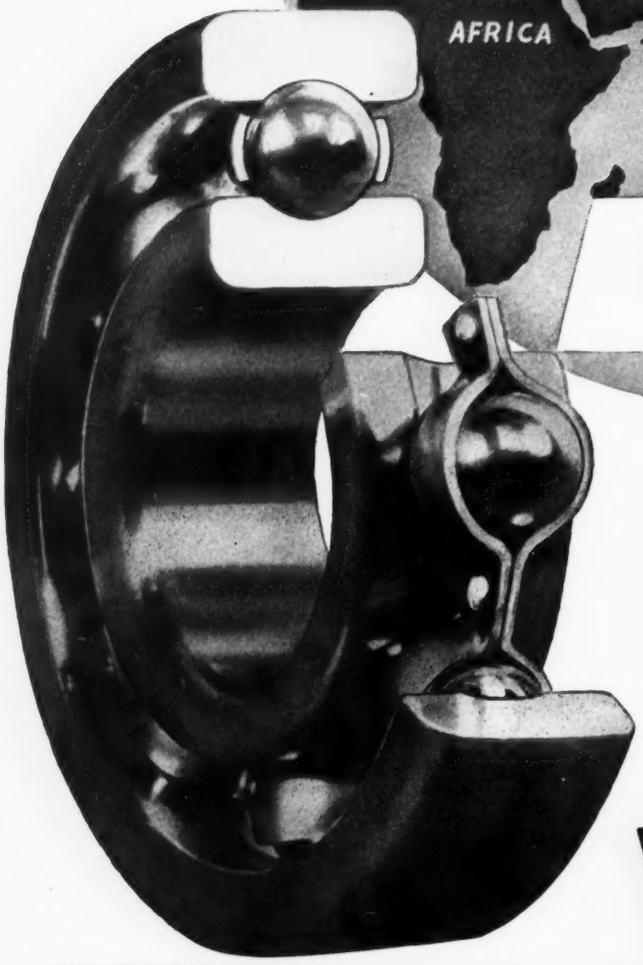
...for Efficiency

The new bombers now coming off American production lines surpass any plane hitherto conceived in deadly efficiency. Potter & Johnston Automatics are contributing their efficiency to the building of these planes. Their automatic features are saving materials, man-hours and machine-hours in the production of many important aircraft parts. Particularly in the field of engine and propeller manufacture are the advantages of P&J Automatics brought to the fore. Large forgings of tough materials are handled easily. Complicated cuts are taken rapidly. Standards of accuracy are easily maintained on a high production basis, because the extreme rigidity of P&J design permits the most advantageous use of high speed cutting alloys. Potter & Johnston Machine Tool Company, Pawtucket, Rhode Island.

AUTOMATICS

Treat Bearings RIGHT!

They're in the FIGHT!



ON EVERY FRONT, mechanized armies depending upon ball bearings, would lose the power of swift movement if deprived of them. Your BCA Ball Bearings are assets of war—truly more valuable than gold! Care for them accordingly. Bearings Company of America, Lancaster, Pennsylvania.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

SUGGESTIONS ON THE CARE OF BCA BALL BEARINGS

1 Use only neutral mineral lubricants.

2 When lubricating with grease, it is not advisable to have the housing more than one-half to two-thirds full.

3 While greasing, vent the grease chamber of housings that have shaft and bearing seals. Otherwise, excessive pressure may cause the destruction or blowing out of the seal.

4 When lubricating with oil, keep only enough in the housing that the lowest ball dips in to one-half its diameter.

5 Keep bearings in their original wrappings until they are to be mounted. Before mounting, thoroughly clean the shaft and housing.

ILLINOIS DESIGN

. . . the expression of INGENUITY *plus* EXPERIENCE!

To create a new tooling principle is an achievement of high order . . . to make its application practical requires the "know-how" resulting from years of experience.

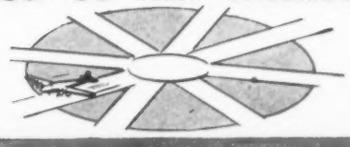
★ ★ ★

Your next tool problem may present a need for such abilities. Knowing where they can be found is vital to an effective solution.

★ ★ ★

"Illinois" has these important tool design essentials . . . and, exceptional production facilities as well. A discussion of your particular problems with our engineers will prove it!

OVERNIGHT TO ALL AMERICA . . .
FROM THE HUB OF AIR TRANSPORTATION



ILLINOIS TOOL WORKS

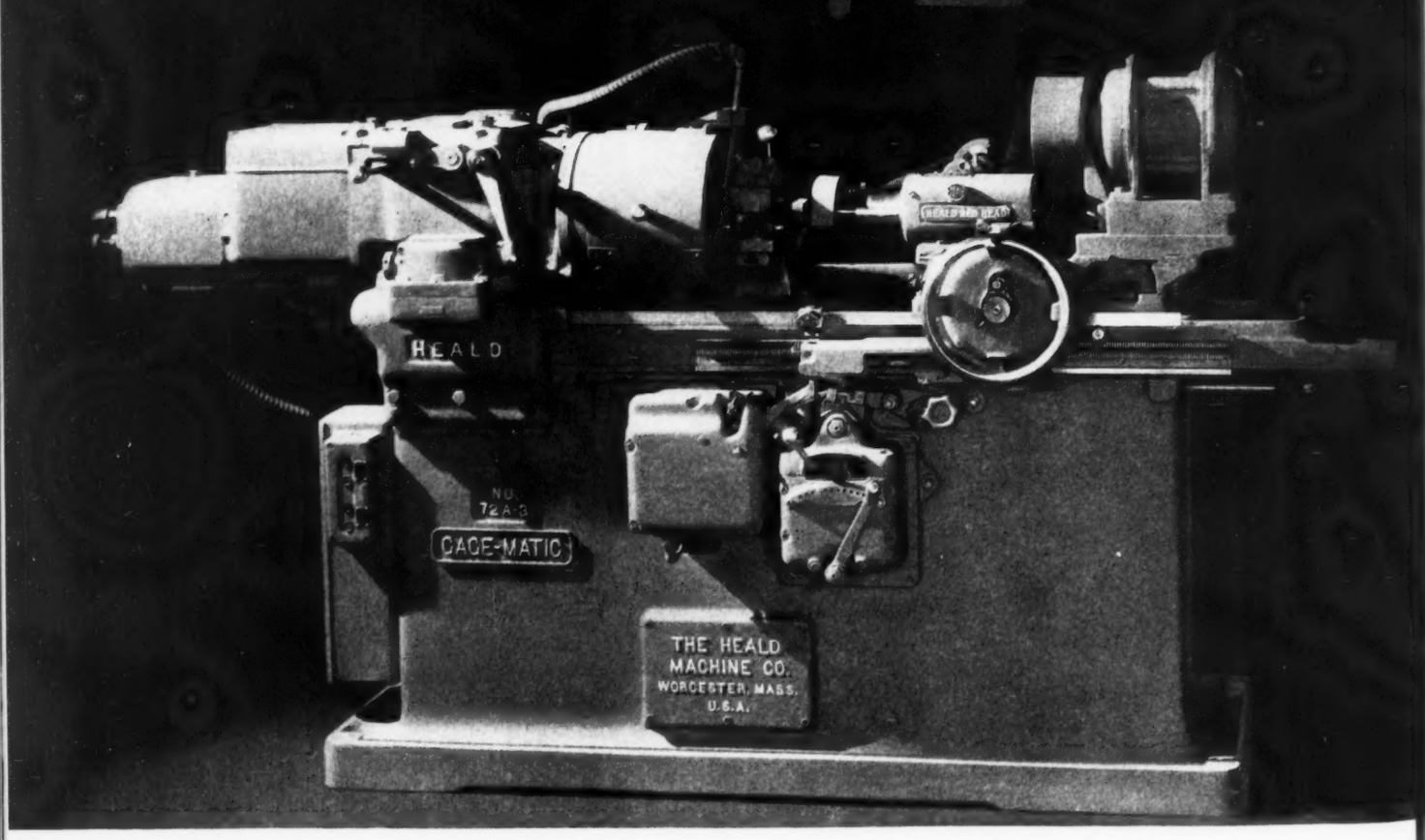
2501 N. Keeler Avenue, Chicago, Illinois

In Canada: Canada, Illinois Tools, Ltd.
Toronto, Ontario

ILLINITE { HOBS • BROACHES • SHAPER CUTTERS • GEAR CUTTERS
MILLING CUTTERS • GROUND FORM TOOLS • SPECIAL TOOLS

ON THE NOSE EVERY TIME

EVEN WITH AVERAGE OPERATORS



Thanks to Automatic Internal Grinding

You're bound to do better and faster grinding with Heald Automatic Internals — they're so easy to operate even for average operators. In fact, Heald Gage-Matics and Size-Matics almost operate themselves, because they are completely automatic except for loading and starting the machine. Their automatic features include automatic grinding to semi-finish size, automatic wheel truing, and automatic grinding to finish size. As a result, these machines make possible uniform accuracy with minimum scrap and reduce operator fatigue. With such features Heald Gage-Matic and Size-Matic Internals are almost human in operation and literally talk production. They'll talk any grinding job into higher production and closer accuracy. Complete information on request.

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

Will Your "FORTRESS" Be Ready On Time?

Think of the months of training and practice this bomber crew put in before they were ready for the real test.

ALTER EGO: And, think of the *years* of effort engineers and shop men put into the development of the "Flying Fortress" . . . all to enable the crew to rule the airways—to navigate in a bee-line to the destination, fight off "competition" all the way, hit the target and get home safely.

Like the YEARS of preparation that'll be required to develop fortresses of knowledge before business crews can expect to rule the post-war market ways.

ALTER EGO: Right! It'll take shrewd management to steer a course of profits . . . ingenious designing to fight off tough competition . . . efficient production to hit the mark of rock-bottom costs and top quality. All of this *to survive.*

All of which is embodied in the practiced use of arc welding. There's our fortress for survival in the Battle for Business. Let's start developing our welding knowledge NOW by consulting Lincoln.

Ask your inner self if time isn't getting short for post-war planning

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

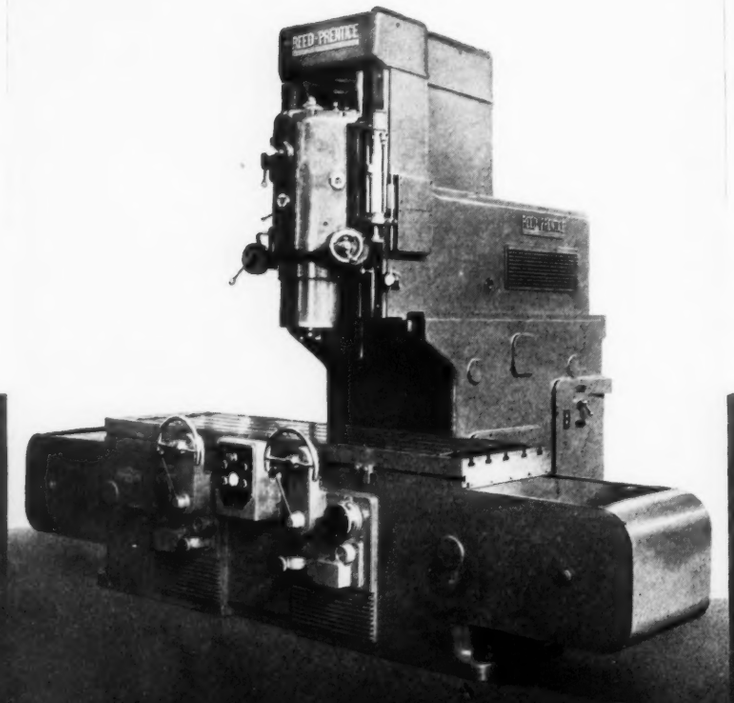
WELDED PRODUCTS HIT THE TARGET

OFFICIAL PHOTO U. S. ARMY AIR FORCES

ENOUGH! IN TIME!

PROMPT DELIVERY!

Performing its continuing tremendous commitments on schedule, Reed-Prentice is still in a position to offer prompt delivery on its new and improved Vertical Milling Machines. More popular than ever the improved No. 3VG Miller is widely used by manufacturers of gun and aircraft engine parts. It excels in die and tool-making. Spindle speeds range from 100 RPM to 4000 RPM.



No. 4 VERTICAL MILLER

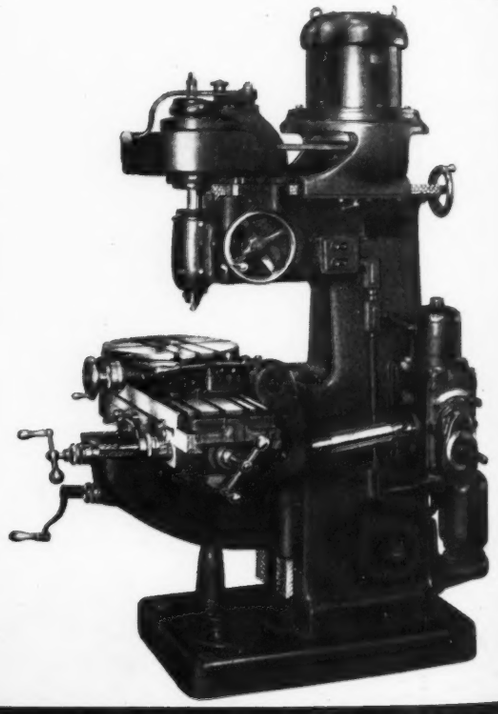
The entirely new No. 4 features centralized controls governing every movement of table, cross-slide, and head. Hydraulically actuated screws insure positive drive to table and cross-slide.

SPECIFICATIONS

TABLE:	Working surface	24" x 84"
RANGE:	Longitudinal travel of table (Can be furnished 60")	48"
	Cross travel of cross slide	24"
	Vertical travel of head	12"
	End of spindle to table—Max. 24", Min.	12"
	Throat depth	33"
	Top of table to under side of cross slide ways	19¾"
MISC.:	Net weight	20,500 lbs.

AGENTS

CHICAGO — Neff Kohlbusch & Bissell
DETROIT — Kordenbrock Machinery Co.
PITTSBURGH — Barney Machinery Co.



No. 3VG VERTICAL MILLER

SPECIFICATIONS

Longitudinal Feed (Power)	24"
Cross Feed	12"
Vertical Adjustment of Knee	18"
Vertical Adjustment Head on Column	5"
Max. Distance, Spindle to Table	18"
Max. Distance, Spindle to Frame	16"
Rotary Table, working surface	16½"
Machine Table, working surface	10¼" x 36"

ARMY NAVY

BRANCH OFFICES
1213 W. 3rd. St.
Cleveland, Ohio
75 West St.
New York City, N. Y.

REED-PRENTICE CORP.

MAIN OFFICE
WORCESTER
MASS. U.S.A.

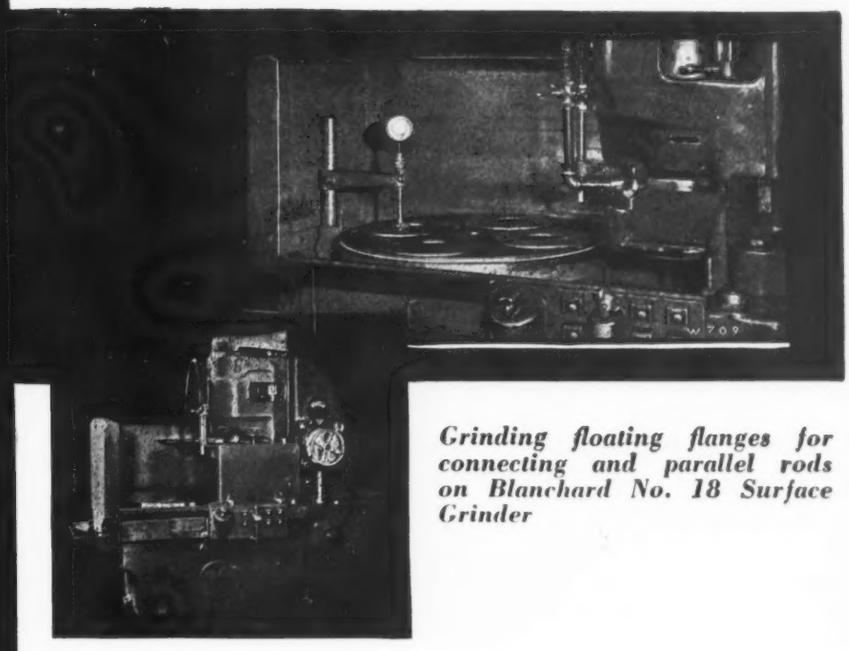
"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- ★ **Material Saving**
- **Fine Finish**
- **Flatness**
- **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Grinding floating flanges for connecting and parallel rods on Blanchard No. 18 Surface Grinder

THE Blanchard No. 18 Surface Grinder, shown above, is used for odd lot jobs in one of this country's leading railway shops. Other jobs up to 36″ in diameter are also ground on this machine.

The job shown is boiler steel floating flanges for connecting and parallel rods. 1/32″ of stock is removed from both sides to limits of .002″ for flatness. 37 pieces (72 surfaces) are produced per hour.

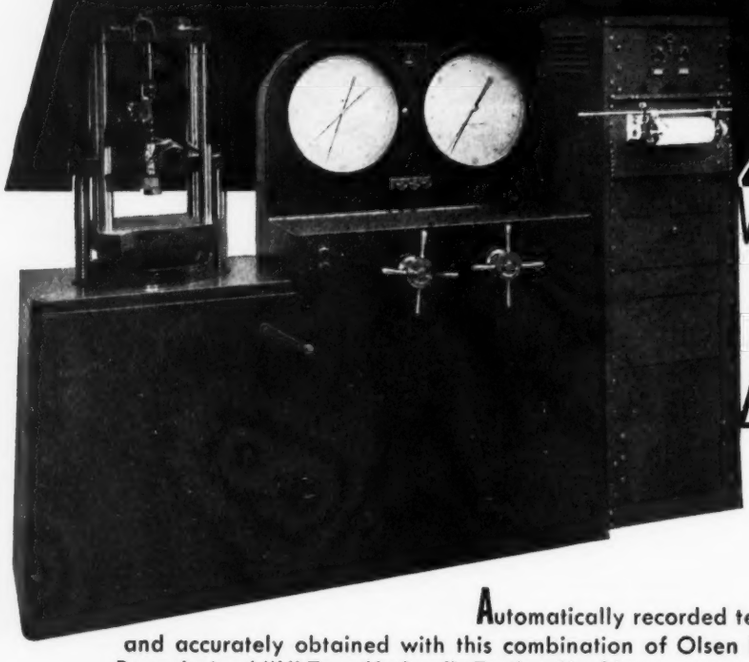
These odd lots are ground at a profit on the Blanchard No. 18 because the set-ups may be changed quickly—the required limits and finish are easily maintained and held —and maximum production is obtained.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

SPEED PRODUCTION TESTING AND ELIMINATE OPERATOR JUDGMENT!

THE OLSEN ELECTRONIC ELONGATION RECORDER FOR L TYPE HYDRAULIC TESTING MACHINES



MATERIAL CHARACTERISTICS IN CHART FORM

1. MAXIMUM STRENGTH
2. PROOF STRENGTH
3. YIELD STRENGTH.
4. TYPE OF YIELD

Automatically recorded tests are quickly and accurately obtained with this combination of Olsen Extensometer, Recorder and "L" Type Hydraulic Testing Machine.

The Recorder weighs the load independently of the gauges of the testing machine by a unique electronic principle which measures the distortion of the Bourdon Tube by a micrometer screw, which gives an inherent linear scale and therefore a single calibration which is retained indefinitely.

The extensometer, which will accommodate 50 thousandths elongation, is connected to the recorder by means of an electric cable — the same accurate Sivertsen System as used in the Olsen High Magnification Recorder. Resultant magnification is 200, measured in inches per inch.

The Olsen Electronic Elongation Recorder with "L" Type Hydraulic Testing Machine is unparalleled in accuracy, speed and simplicity of operation. This equipment is in wide use in production testing, laboratories, colleges, and research organizations. It is the preferred method of recording basic material characteristics quickly and conveniently.

TINIUS OLSEN TESTING MACHINE CO.

530 N. TWELFTH ST., PHILADELPHIA, PA.

WESTERN REPRESENTATIVE, PACIFIC SCIENTIFIC COMPANY

LOS ANGELES SEATTLE SAN FRANCISCO

Proving Every Day that the Value of Testing Depends on the Quality of the Testing Equipment.

LIFEBLOOD

In more than 100,000 industrial plants, Dayton V-Belts are the arteries through which pulse the lifeblood of productive power . . . power that is smooth-flowing and dependable . . . power which enables millions of machines of every type to convert raw materials into battle weapons, supplies and materiel.

Today, when every machine must operate around the clock, these strong, flexible, long-life Dayton V-Belts increase output—cut power losses and reduce maintenance time and costs to a negligible minimum. And because Daytons run cool and grip firmly they assure closer speed control.

Built-to-bend Daytons operate on short centers to save precious floor space and permit better location of machines for high-speed production.

For service—or for helpful suggestions regarding the conservation of V-Belts through proper application and maintenance procedure—call the Dayton Distributor who is located nearby to serve your wartime needs. His stock of V-Belts is supplemented by strategically located factory warehouses and his advice or services are yours for the asking.

THE DAYTON RUBBER MFG. CO.
The World's Largest Manufacturer of V-Belts
DAYTON, OHIO

DAYTON RUBBER EXPORT CORPORATION
38 Pearl Street, New York, N. Y. U. S. A.

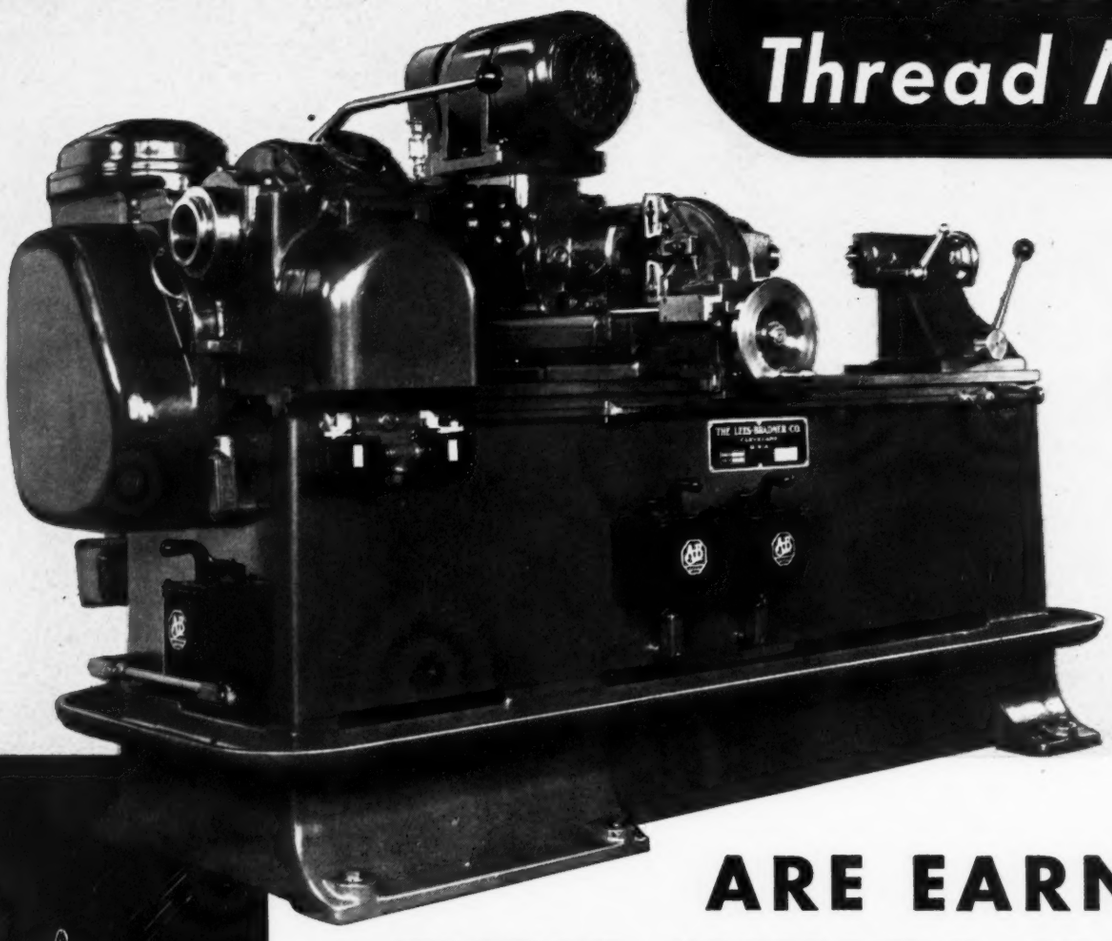
THROW YOUR SCRAP INTO THE FIGHT!
BUY WAR BONDS AND SAVINGS STAMPS

Dayton V-Belts
LIFELINES OF POWER VITAL TO VICTORY

Copyright 1943, The Dayton Rubber Manufacturing Co.

THE GREATEST NAME IN V-BELTS

LEES-BRADNER Thread Millers



MODEL LT
LIGHT
TYPE

ARE EARNING THEIR WINGS IN THE AIRCRAFT INDUSTRY

The many LT Thread Millers working around the clock in countless airplane plants is ample proof of the dependable accuracy and high production these plants expect . . . and get from Lees-Bradner Thread Millers. The Model LT is suitable for either disc or hob type threading on work up to six inches diameter. Available in several lengths . . . rated capacity of 1" circular pitch.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

"All There Is In Bearings"

Timken Tapered Roller Bearings possess everything required of bearings in all kinds of machines; ability to eliminate friction; to minimize wear; to carry radial, thrust and combined loads; and to maintain moving parts in constant alignment.

Naturally, the more Timken Bearings any machine contains, the greater the protection it receives and the more efficiently it performs.

The engineer who realizes this and acts accordingly, not only gives his company *better* machines, but likewise *better selling* machines because the trade-mark "TIMKEN" is a universally accepted guide to superiority.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

HELP ASSURE VICTORY

Buy War Bonds. Conserve Rubber. Eliminate Unnecessary Travel. Use the Telephone Only When Important. Salvage All Scrap and Waste Material.

All Timken Bearing production now goes into fighting machines. However, the Timken Bearings in your motor vehicles or industrial machines will see you through the emergency—and beyond it—if you make sure they are lubricated and inspected regularly.

We do not make Electronic Tubes

WE ARE HELPING TO MAKE THEM BY NOT USING TANTALUM

TANTALUM is an essential element in the electronic tubes used in planes, tanks, ships, "subs," listening devices, "walkie-talkies," and wherever radio or sound equipment or "electric eyes" are used. We are urged to save Tantalum as a scarce, allocated metal on the "most critical" list.

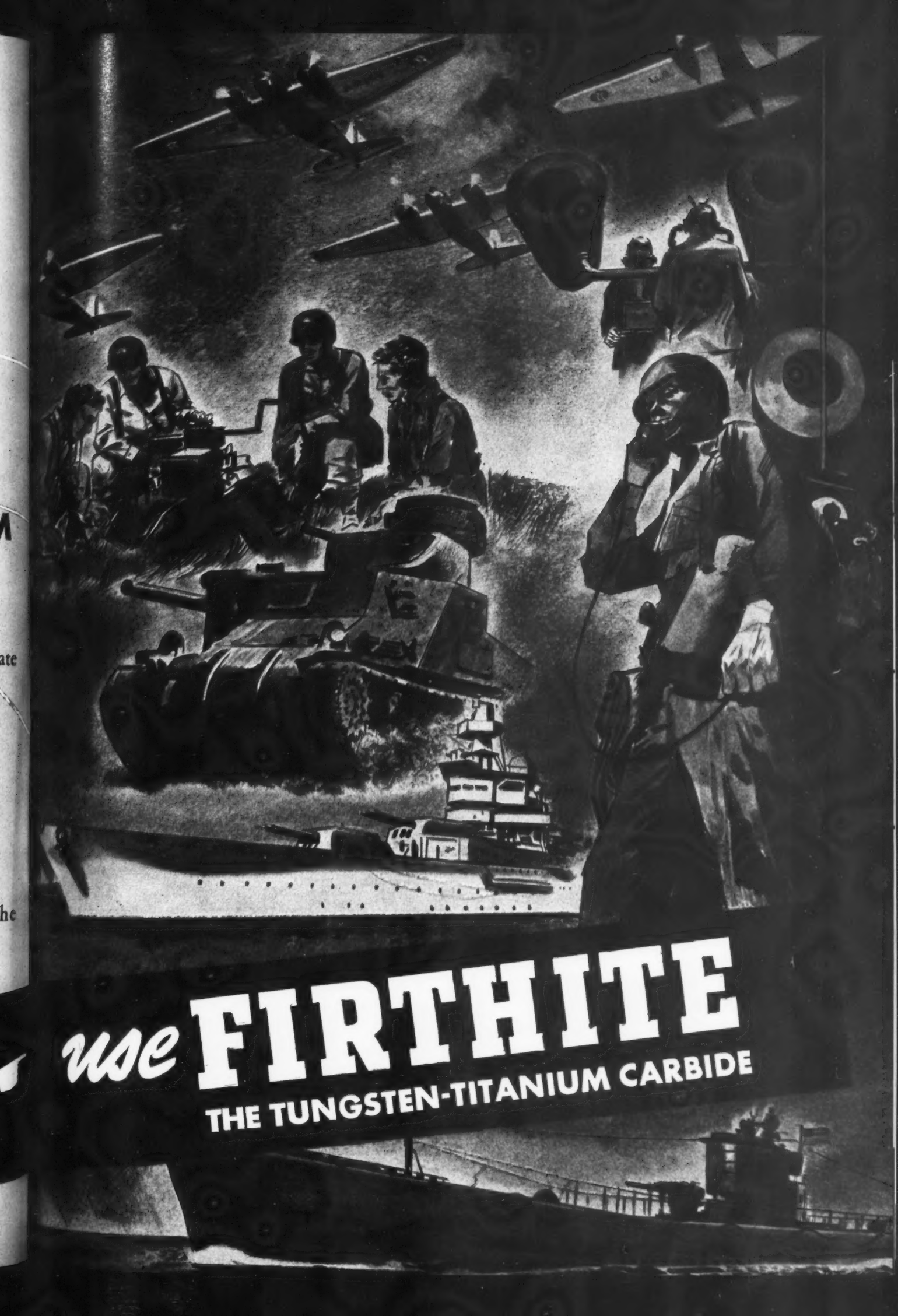
FIRTHITE RESEARCH has enabled us to produce a steel-cutting sintered carbide of superior quality in which Tantalum is **unnecessary.** FIRTHITE Engineers are prepared to demonstrate the Tungsten-Titanium type which:

(1) Is made from domestic alloys;
(2) Is cheaper than the Tantalum types;
(3) Steps up production of steel products;
(4) Releases Tantalum for more essential uses.

May we prove the value of the Tungsten-Titanium type to you?

Firth-Sterling
STEEL COMPANY

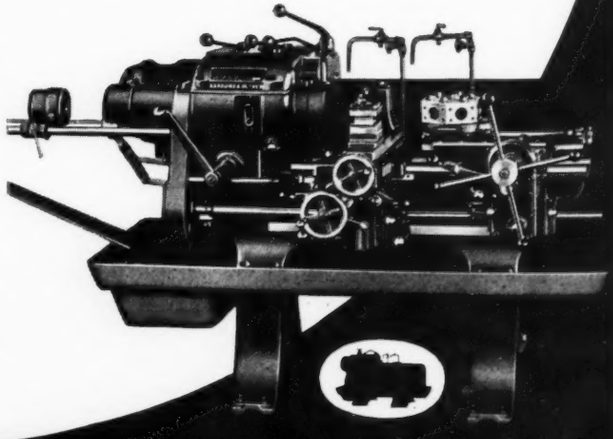
OFFICES: McKEESPORT, PA. NEW YORK - HARTFORD - PHILADELPHIA
CLEVELAND - DAYTON - DETROIT - CHICAGO - LOS ANGELES


use FIRTHITE
THE TUNGSTEN-TITANIUM CARBIDE

NO. 3 UNIVERSAL TURRET LATHE IS *Easy for Women to Operate*

Because of its light weight, compact and rigid design the Bardons & Oliver No. 3 Universal Turret Lathe responds readily to the quick and sensitive touch of the skilled woman operator. The results are increased speed of production and higher quality of work.

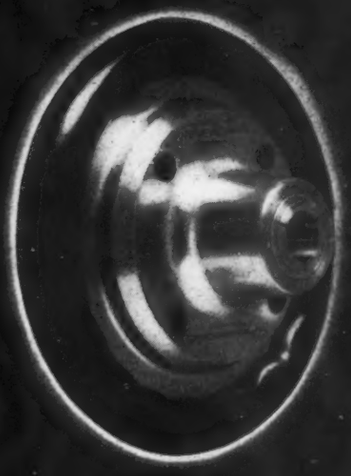
If you are employing women to produce small parts from bars, forgings or castings, and the demand for your product is growing, let us give you further information.



1133 W. 9th STREET
CLEVELAND, OHIO

HARDINGE - SJOGREN

SPEED COLLET CHUCKS



For CAM-LOCK SPINDLES

For TAPERED KEY-DRIVE SPINDLES

For THREADED NOSE SPINDLES

Are you getting full value from your investment in tool-room and engine lathes?

A Hardinge-Sjogren Speed Collet Chuck gives greater capacity, saves time, increases accuracy and assures better results.

It is readily adapted for use on the spindle nose of your lathes, takes precision collets – enabling the operator to do better work . . . faster!

Available in three sizes: 1", 1-3/8" and 1-3/4" capacity.

Furnished with Hardinge Precision Collets.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
ELMIRA, N.Y.

"TO GET THERE *Fustest* WITH THE *Mostest*"..

Official U. S. Navy Photograph

ARMY E NAVY

BULLARD

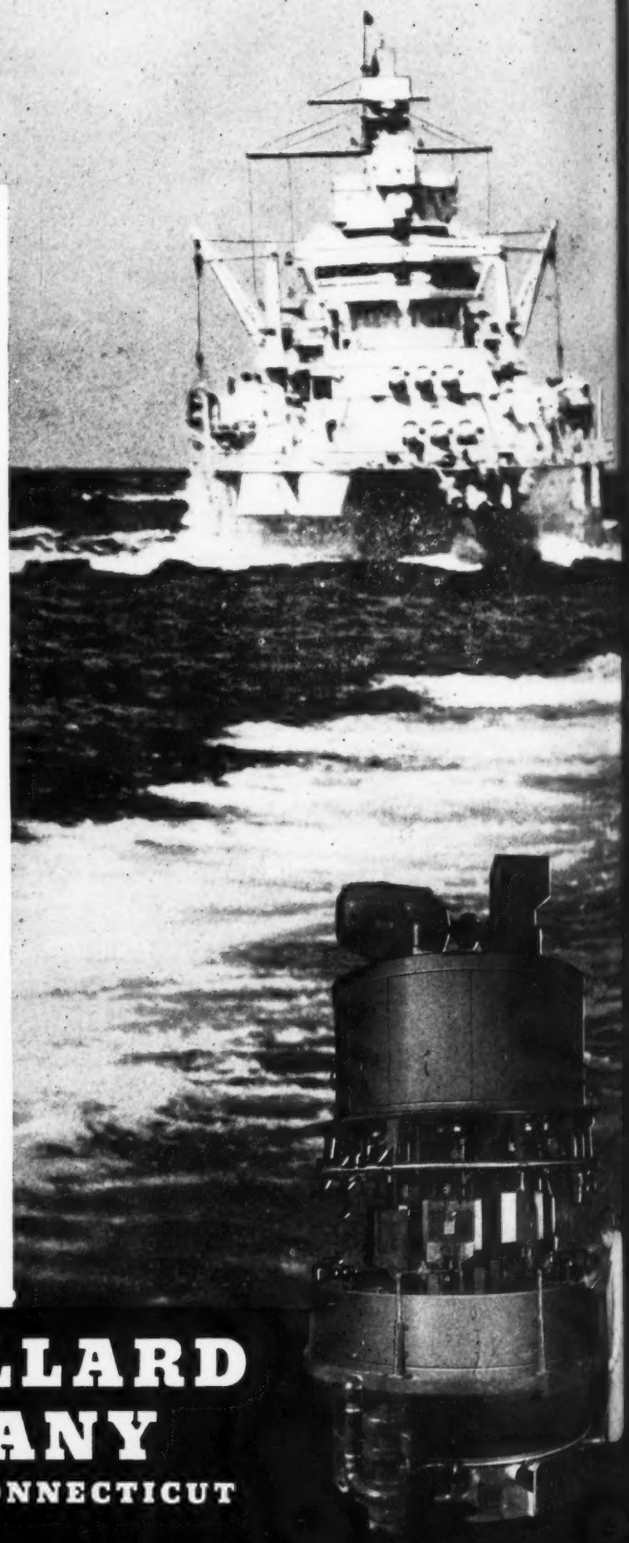
The old formula for victory still holds good today. But to achieve it is infinitely harder.

Our men today spend shells by the thousands of millions. They need bombers, fighters, tanks, ships, everything else in proportion. Yet each airplane engine, every tank tread sprocket, every ship's compressors must have the accuracy once deemed possible only for hand workmanship.

Hence, it is inevitable that America's war industry relies heavily upon the Bullard Mult-Au-Matic, the machine on which one worker can do the work of seven men . . . and turn it out within the closest of tolerances.

Bullard V.T.L.s, too, man the production lines which send out most of America's transport planes . . . and are veterans at building ships and locomotives.

Bullard engineers want to be sure that you are set up to get your "Mostest" from every job you do. Send them your data . . . they may enable you to cut your times still further.



THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

SAE 4130 aircraft screw ⅞" hex. head, ⅜" body, 2" long, threaded 1" on Model B Cleveland Single Spindle Automatics. Tool-life increased 25% . . . using *Texaco Sultex B.*

CHANGING cutting coolants on this job of machining Molybdenum steel aircraft screws produced as good a finish, but TOOL-LIFE increased 25%.

The cutting coolant that made this substantial improvement was *TEXACO Sultex Cutting Oil B.*

This is one more instance of the fact that the selection of *Texaco Cutting Oil* not only can increase tool-life, but by keeping down the heat, can prevent chip welding, improve finish, reduce tool adjustment, minimize spoilage.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

TEXACO REG. T.M.

TEXACO Cutting and Soluble Oils
FOR FASTER MACHINING

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

FIGHTING TOOLS NOT FIGHTING TALK!

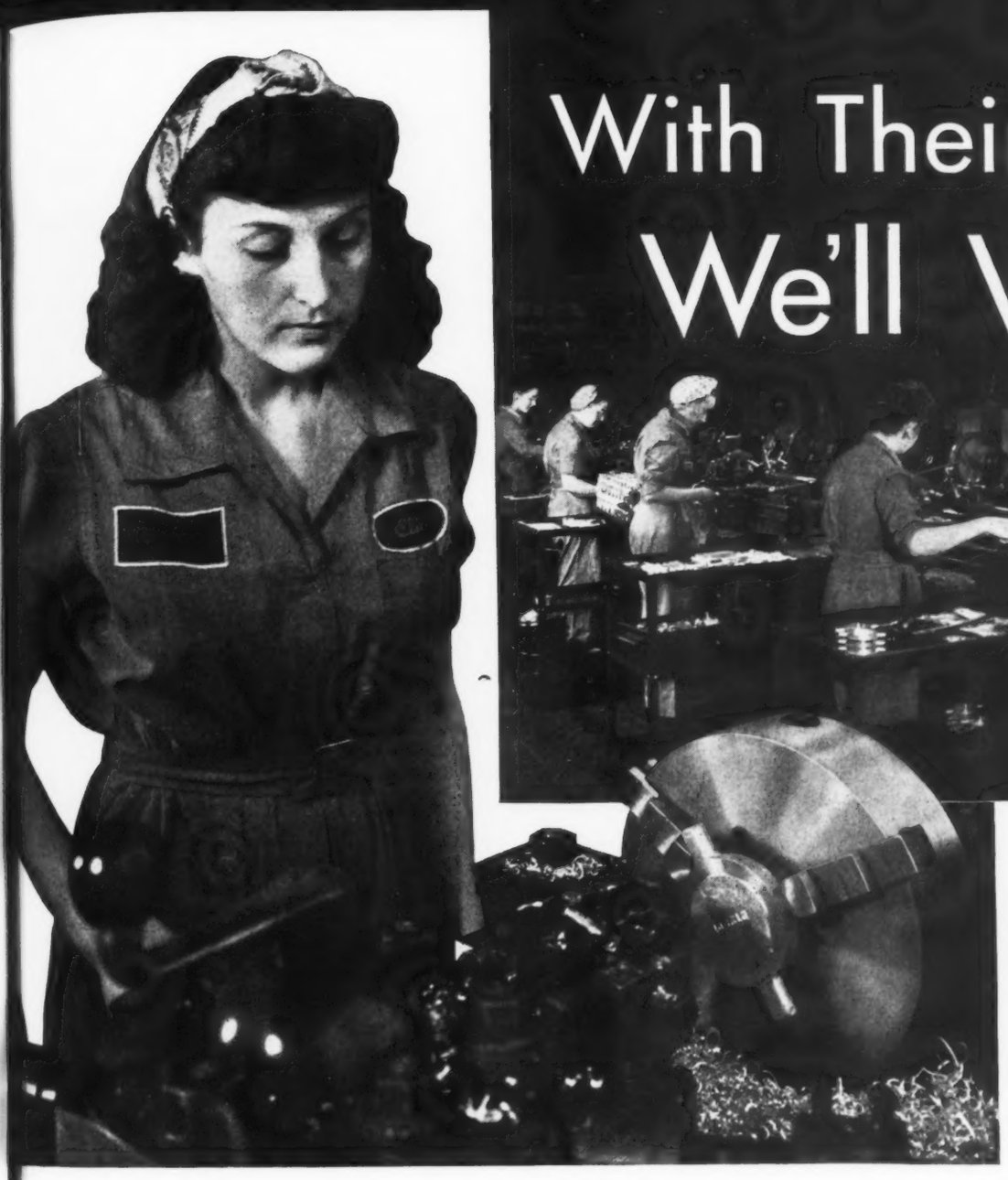
Ship worn-out High Speed Tools back to the steel mills – this high grade steel can do another war job.

If you want high production and accuracy from machine operators, give them high-grade cutting tools. Fighting tools – not fighting talk – produce results!

MORSE TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

With Their Help We'll Win



These women, machining precision parts on South Bend Lathes in a vital war plant, are typical of thousands of women who are doing their part to win the battle of production.

With eager hearts and nimble fingers, thousands of American women are working shoulder to shoulder with men in vital war industries — replacing those who have left their machines to defend their country. And they are doing a fine job of filling men's shoes, for they know that the battle of production must be won to keep their men at the front supplied with the guns, planes, tanks, bullets, and thousands of other things an army must have to be victorious.

Women learn to operate South Bend Lathes in a surprisingly short time. Not that just any girl can become an expert machinist or toolmaker over night. But on certain classes of work—the kind of work you would expect a beginner to do—women are highly successful.

Quick to appreciate quality, women like South Bend Lathes. They like the fully enclosed design with no exposed pulleys, belts, or gears—the smooth operation of conveniently placed controls—the absence of rough edges and sharp corners that might catch their clothing—the dependable precision that enables them to turn out maximum production, even when extremely close tolerances are specified. And, most of all, they appreciate the ease of operation which reduces fatigue to a minimum and seemingly shortens the work-day by hours.

South Bend Engine Lathes and Toolroom Lathes are made in four sizes, 9″ to 16″ swings. South Bend Turret Lathes are available in three sizes. Write for information, specifying size and type of lathe in which you are interested.

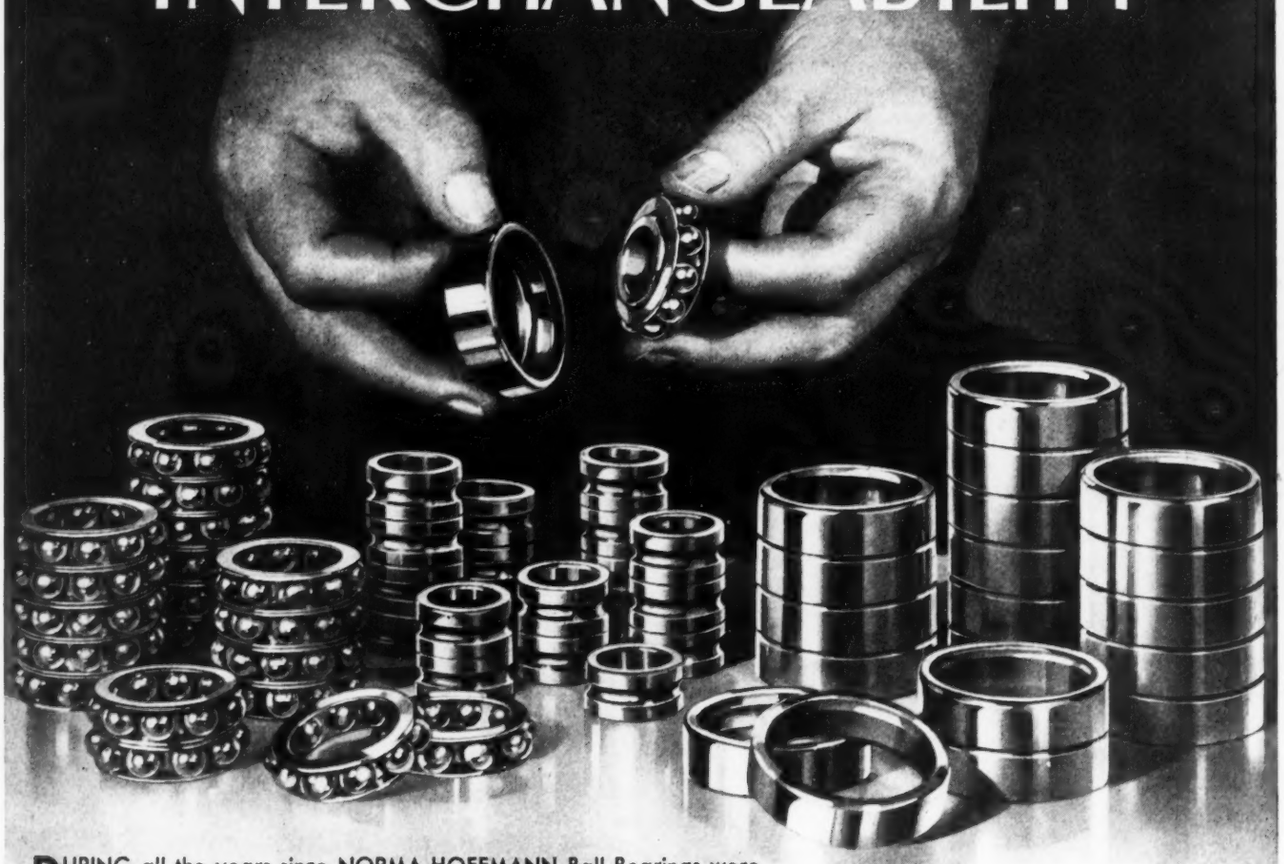
"HOW TO RUN A LATHE"
A valuable handbook for apprentice training. Explains the operation and care of engine lathes. 128 pages—365 illustrations. Sent postpaid for a 25c War Stamp.

ARMY E NAVY

SOUTH BEND LATHE WORKS
SOUTH BEND, INDIANA — LATHE BUILDERS FOR 36 YEARS

TRADE MARK SOUTH BEND TWINS ENGINE LATHES

A THIRD OF A CENTURY of INTERCHANGEABILITY



DURING all the years since NORMA-HOFFMANN Ball Bearings were introduced, PRECISION has been their distinguishing feature.

"But"—we are often asked—"has this PRECISION been unvarying, over all these years?"

An actual test of the INTERCHANGEABILITY maintained in day-after-day, year-after-year NORMA-HOFFMANN production would (we believed) give a convincing answer to the question—since, in the bearing world, INTERCHANGEABILITY of parts cannot be realized unless PRECISION is maintained.

So we secured a number of stock NORMA-HOFFMANN Open Type Ball Bearings—some made 30-odd years ago, others at intervals since. These we dis-assembled and "mixed up"—interchanged inner rings, cages with balls, and outer rings—and reassembled them into complete bearings which were then subjected to our rigid PRECISION tests.

In every case, we found the reassembled unit to be a true NORMA-HOFFMANN PRECISION Ball Bearing, with internal accuracy unchanged and in every respect conforming to our exacting standards.

This is NORMA-HOFFMANN PRECISION—not new or variable or "special"—but a time-tested, inflexible standard of quality. This PRECISION is YOUR assurance of bearing speed-ability and service-ability—YOUR safeguard against bearing troubles.

•

WRITE FOR THE CATALOG
LET OUR ENGINEERS
WORK WITH YOU

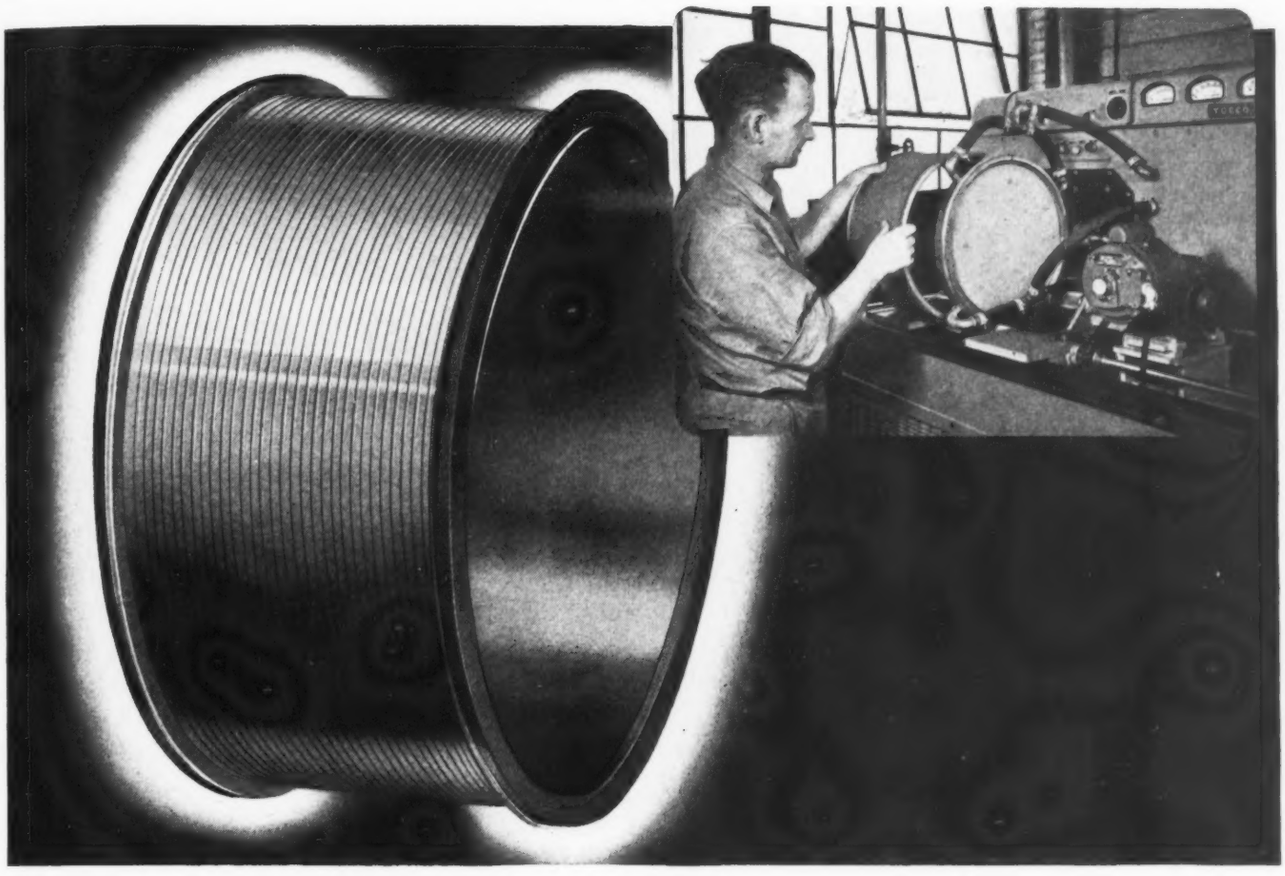
•

NORMA-HOFFMANN PRECISION BEARINGS

• • • •

BALL • • ROLLER • • THRUST
for
EVERY LOAD, SPEED AND DUTY

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. . . . FOUNDED 1911



HARDENED AND DRAWN BY TOCCO
IN 90 SECONDS

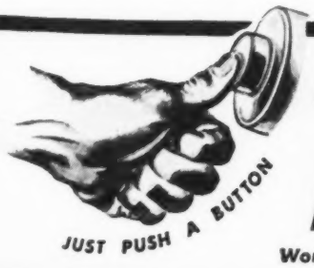
TYPICAL of TOCCO's speed-up of war production is its heat-treatment of 21-inch tank bogey wheels. Here is the split-second time for hardening and drawing a rim—*all in one operation*—from the moment of pressing the "start" button:

Time to heat to 1600° F. . . .	**17.5 sec.**
Time to quench	**14.0 "**
Time to draw	**13.5 "**
Total time per rim	**45.0 sec.**

Total TOCCO-treating time for both rims is only 90 seconds! This speedy, uniform hardening and drawing, localized at the wearing surfaces, has eliminated rejects due to cracking and has materially increased production output. Hardness of rims as drawn (S. A. E. 1335 steel) is 285-381 Brinell.

Find out how TOCCO electrical induction can speed-up and improve *your* war production. The same standard TOCCO machine, with a simple change of work fixture, can be adapted to the *low-cost* hardening, annealing, brazing or heating of peacetime products.

THE OHIO CRANKSHAFT COMPANY
Cleveland, Ohio



TOCCO

World's Fastest, Most Accurate Heat-Treating Process

HARDENING
ANNEALING
BRAZING
HEATING for
forming and forging

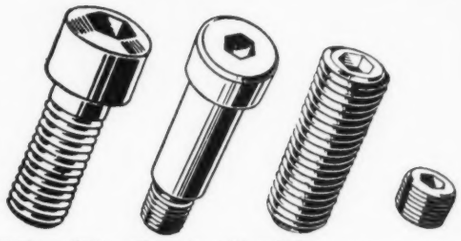
NO PLACE FOR "Doubtful Screws"

—In Power Tools that Must Do Double-Shift Duty!

War production schedules have proved that motor-driven bench and hand tools deserve something better than the pre-war classification of "light duty tools". Countless grinders, drills and other tools operate on a double-shift, often substituting for heavy machines. And, they don't "give up" under the unexpected strains.

The reason lies in the policy of the builders to make "hundred-dollar" tools as though they were "thousand-dollar" machines. Every integral part must satisfy rigid standards . . . doubtful materials will not be trusted.

That policy has put Parker-Kalon Quality-Controlled Socket Screws on the "preferred list" of a good share of the power tool builders, and the makers of the motors that drive them. For P-K Socket Screws are made to the same uncompromising standard. "Doubtful screws" . . . screws that *look* all right but some of which fail to *work* right . . . are barred by the unequalled quality-control routine of the Parker-Kalon Laboratory. P-K Screws have the extra dependability to stand unexpected strains . . . yet they cost no more. Parker-Kalon Corporation, 202 Varick Street, New York.



"Quality-Controlled" means . . .

Complete test and inspection covering; Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; and Thread fit.

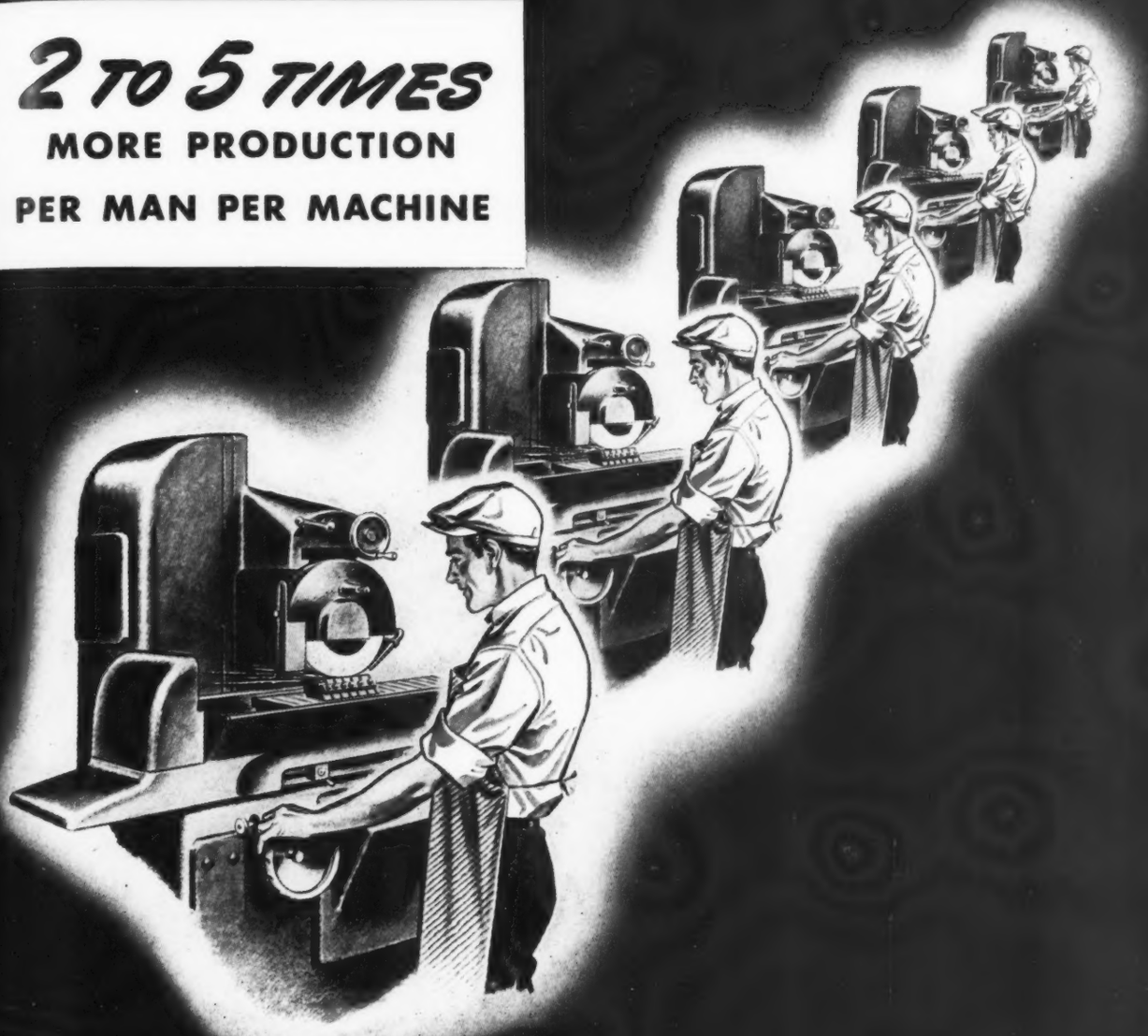
PARKER-KALON

Quality-Controlled

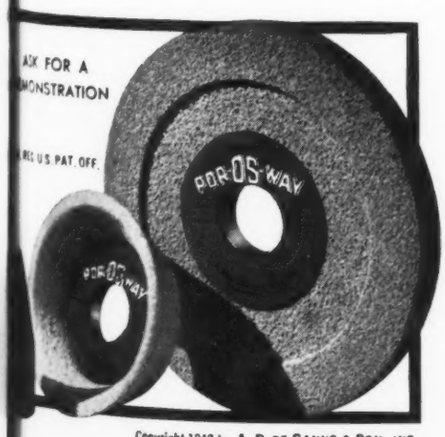
SOCKET SCREWS

Give the Green Light to War Assemblies

2 TO 5 TIMES
MORE PRODUCTION
PER MAN PER MACHINE



This new precision grinding wheel "breathes." Millions of air cells cool. Result: 100% to 400% faster cutting



Copyright 1942 by A. P. DE SANNO & SON, INC.

FIGURE THE EFFECT on your production of speeding up grinding from 100% to 400%. This new grinding wheel may do it for you, too.

The principle of Por-os-way is new. The method of manufacture is new. The bond used is new. Instead of a "sandy" or compact structure, Por-os-way is *cellular* and "stringy" like a sponge; contains millions of air cells which cool each grinding point between contacts.

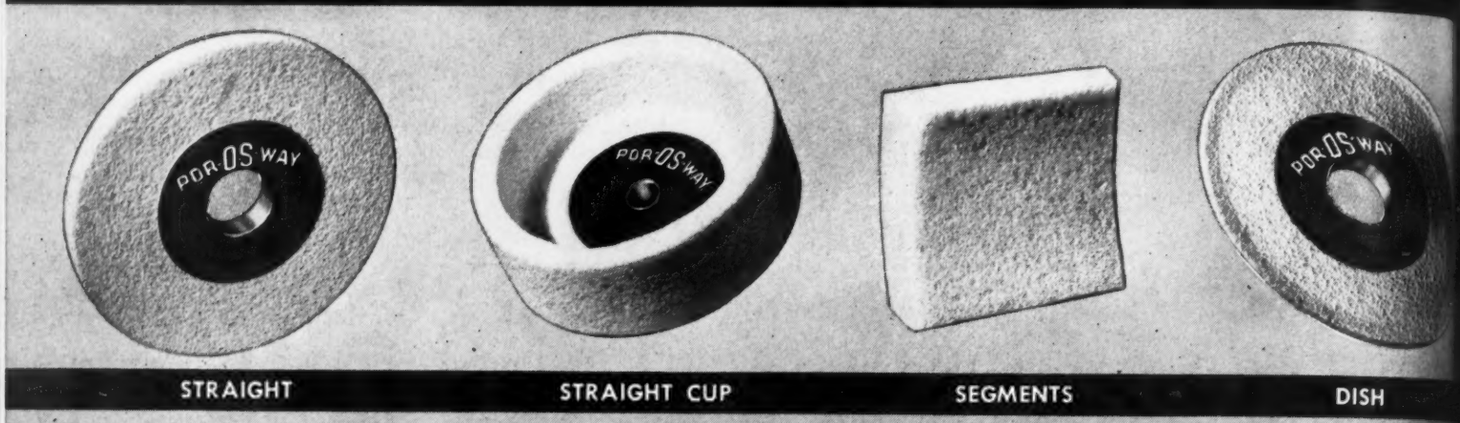
Por-os-way takes deeper cuts, breezing through .010" or more. It grinds from 100% to 400% faster. It increases production per man, per machine 2 to 5 times. And that's not all. Por-os-way shows little tendency to load or burn the work. Use it on hard tool and die steels. It is hard, tough, holds its corner with very little dressing.

On soft materials—copper, rubber, wood, plastics—Por-os-way is free cutting and does not easily load. Make a test! Write today for the booklet that "tells all" about Por-os-way and that opens the way for the prescription of porosity, grade and grain best fitted for your job. Por-os-way wheels are not "stock" wheels. A. P. DE SANNO & SON, INC., 428 Wheatland St., PHOENIXVILLE, PA.

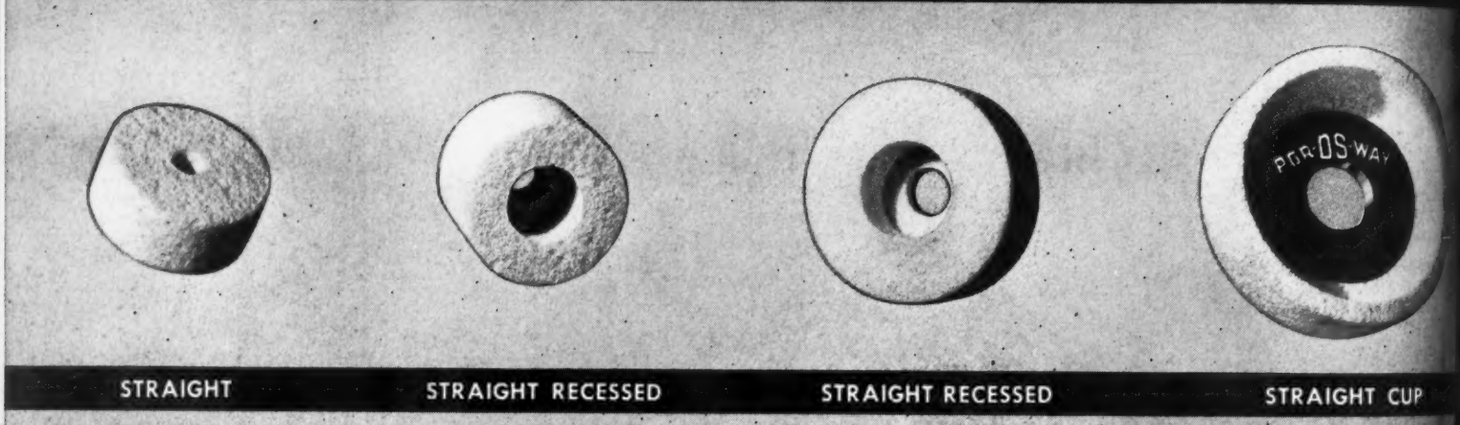
POR-OS-WAY* *a new* **RADIAC* PRODUCT**

(TURN PAGE, PLEASE)

A PRECISION WHEEL FOR PRECISION PURPOSES AND EVERY WHEEL A POR-OS-WAY

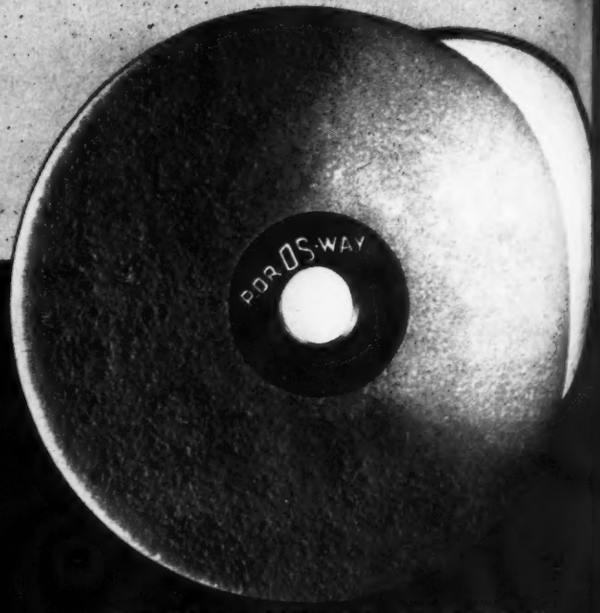


STRAIGHT | STRAIGHT CUP | SEGMENTS | DISH



STRAIGHT | STRAIGHT RECESSED | STRAIGHT RECESSED | STRAIGHT CUP

FLARING CUP | STRAIGHT



POR-OS-WAY* *a new* RADIAC* PRODUCT

DO THIS—MAKE THE LIGHT TEST

Hold a Por-os-way wheel up to a light bulb. Note the even spread of light. No soft spots to wear away quickly, no dense spots to encourage glazing. The light is evenly diffused. The uniform structure of the wheel gives you uniform wear.

How TO ORDER GAGES

When an order for fixed size gages fails to include complete gage specifications, the missing information must be gotten by further correspondence before the order can be put in production. This delays procurement of these vital tools and it also puts an extra burden on the time of procurement personnel. Both can be prevented by including all the following information on gage orders.

It is always strongly recommended and good practice to order a setting plug for every thread ring gage purchased because there is no other good way of accurately checking ring gage wear or of resetting the ring gage to compensate for that wear.

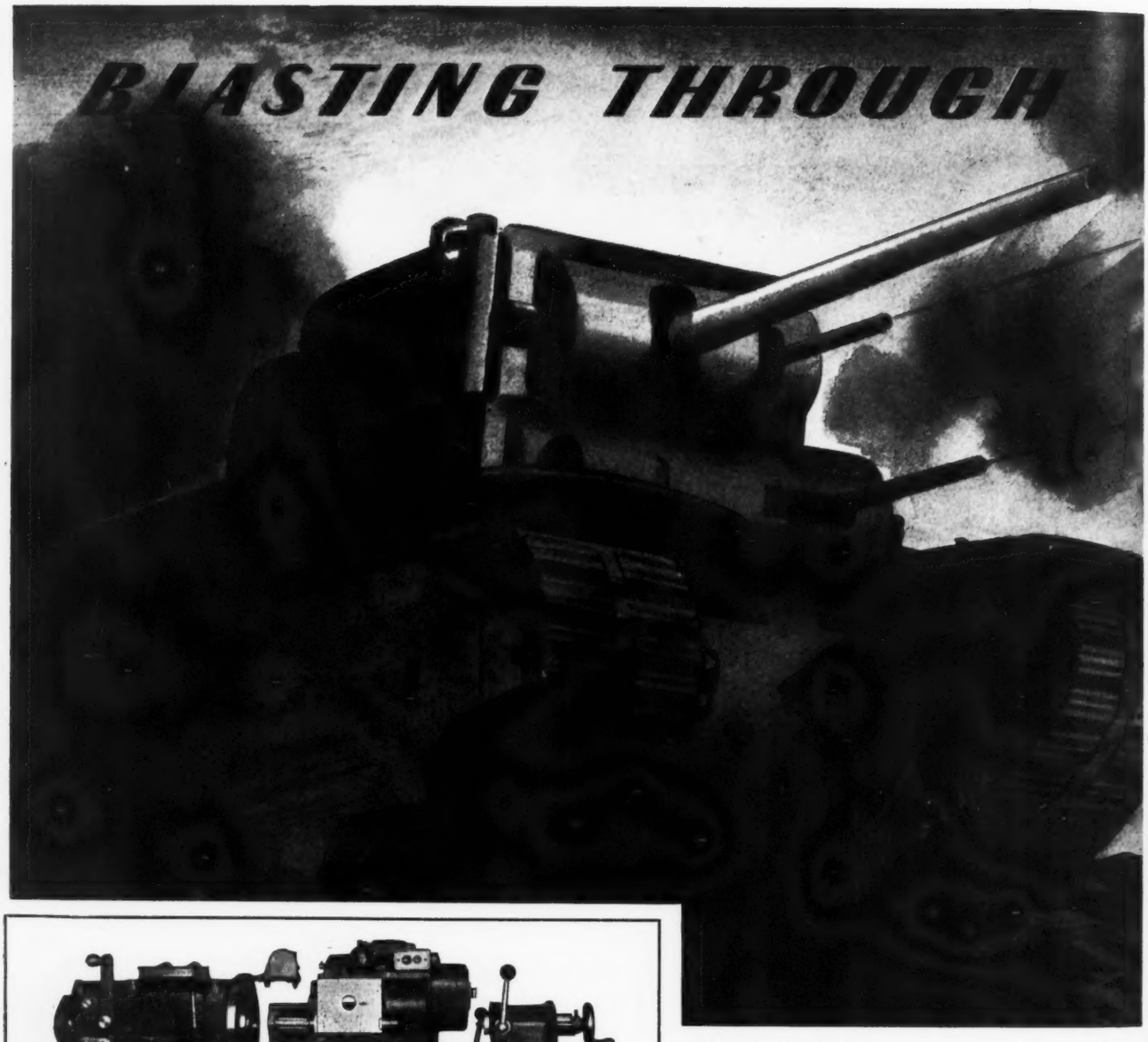
The gage maker does not set and seal a thread ring gage unless he also furnishes a setting plug. He cannot do this because of the three variables involved, pitch diameter, lead, and thread angle. Every one of these is interrelated and every one may vary within its own tolerance zone. Thus, a thread plug and a thread ring made at different times or by different manufacturers may both be well within their tolerance limits in every element and still, because of these small cumulative differences, the two might not fit together precisely. When both the ring and the setting plug are made together, these differences can be adjusted, but not otherwise.

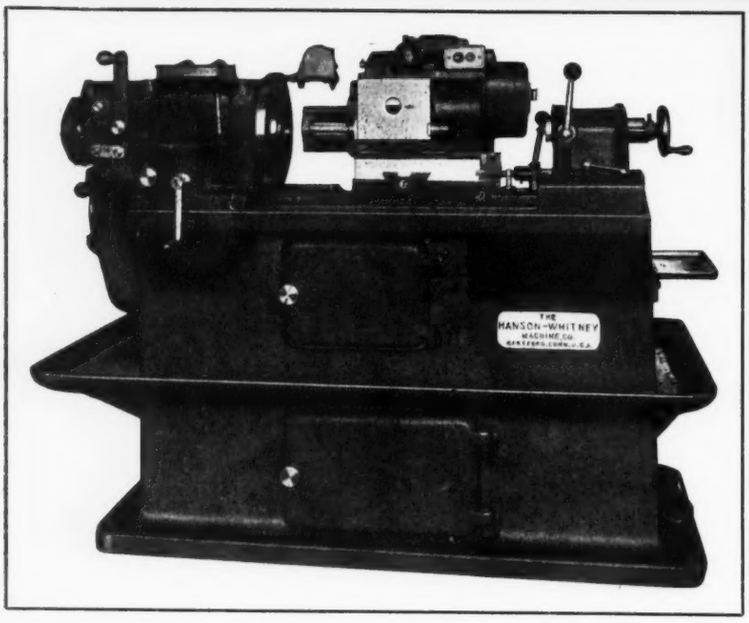
SHEFFIELD GAGES MASTER GAGEMAKERS

THE *SHEFFIELD*

CORPORATION

DAYTON, OHIO, U. S. A.





H-W Universal Semi-Automatic Thread Milling Machines are playing an important part in producing Allied machines of war. The H-W Milling Process permits the working of many previously hard-to-thread materials . . . and, by applying the multiple cutter principle, threads of all lengths within the capacity of the machine are completed in one revolution. External, internal and taper threads . . . right or left hand . . . can be cut with equally high speed, precision accuracy and convenience. If you have a threading problem call Hanson-Whitney.

Hanson-Whitney 8" x 16" Semi-Automatic Thread Milling Machine

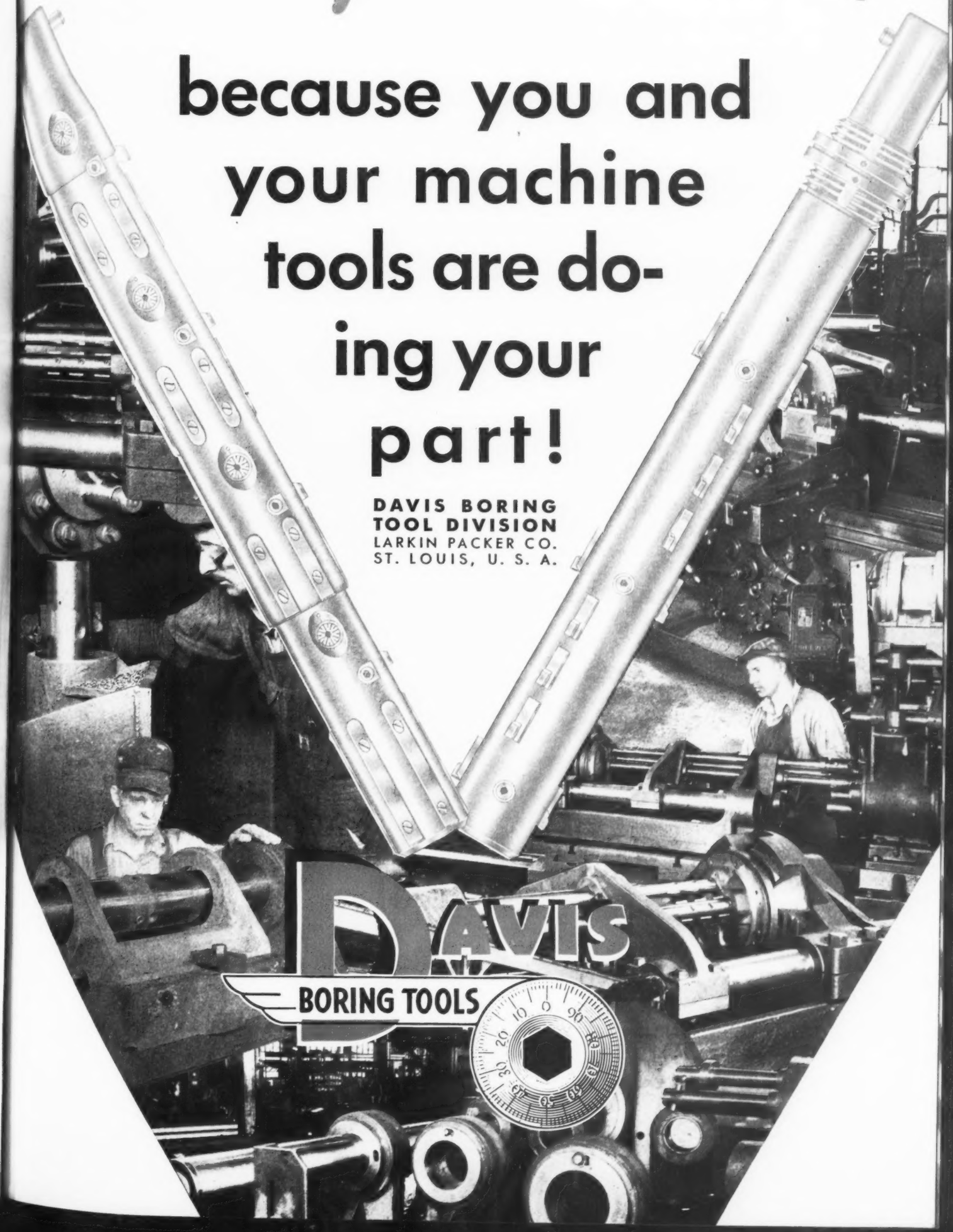
The HANSON WHITNEY MACHINE CO

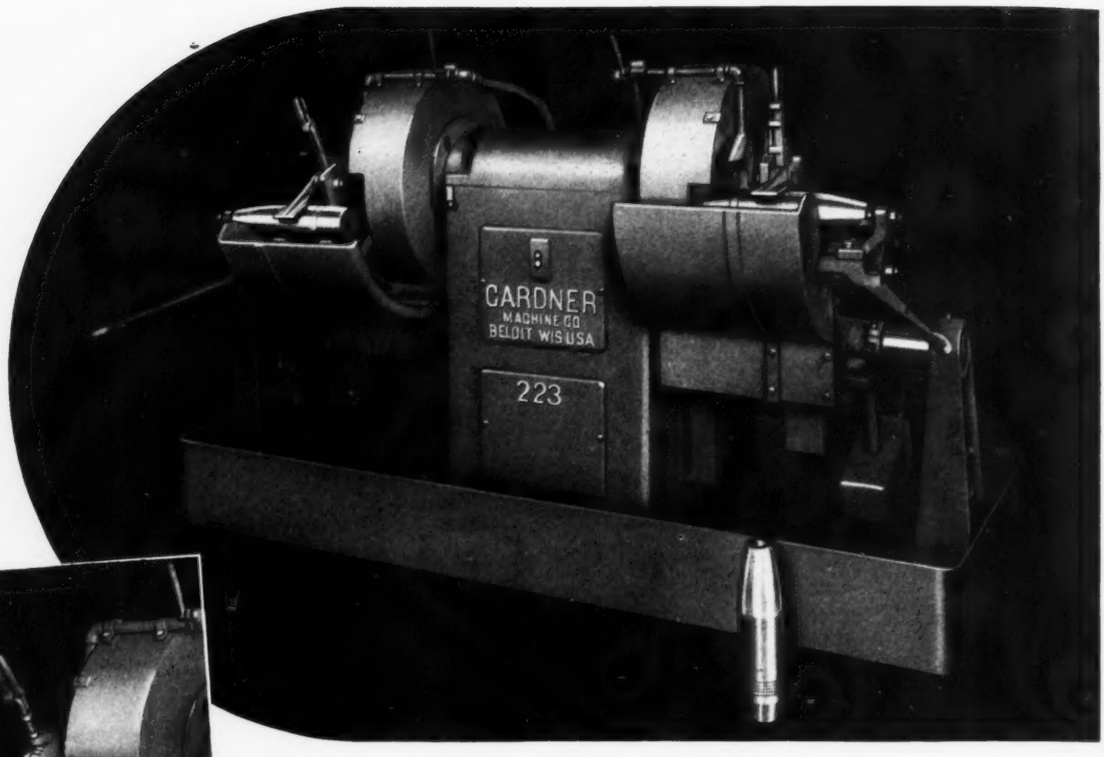
HARTFORD CONN., U.S.A.

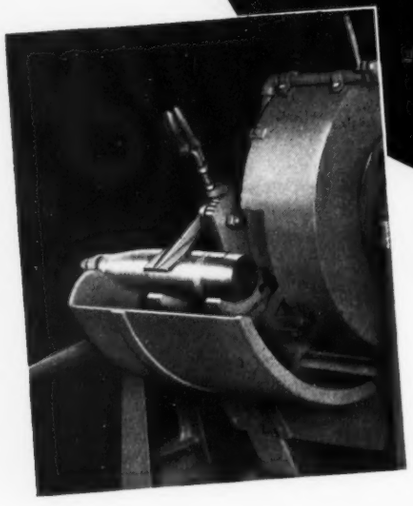
Plenty—ON TIME,

because you and your machine tools are doing your part!

DAVIS BORING TOOL DIVISION
LARKIN PACKER CO.
ST. LOUIS, U. S. A.







Helping *speed* these "105's" *toward Tokyo!*

DEPENDING upon the manufacturing "set-up", many shells like the 105 millimeter illustrated here, must be ground on the butt end.

A Gardner No. 223-23" Standard Single Spindle Disc Grinder, equipped with 2 special hand-clamping fixtures mounted on lever-feed tables, is representative of a number of Gardner Grinders which have been installed for this work. Two operators are used on this particular unit, of course.

PRODUCTION: 50 to 60 shells per hour, per operator, removing 1/16" maximum stock for a clean-up.

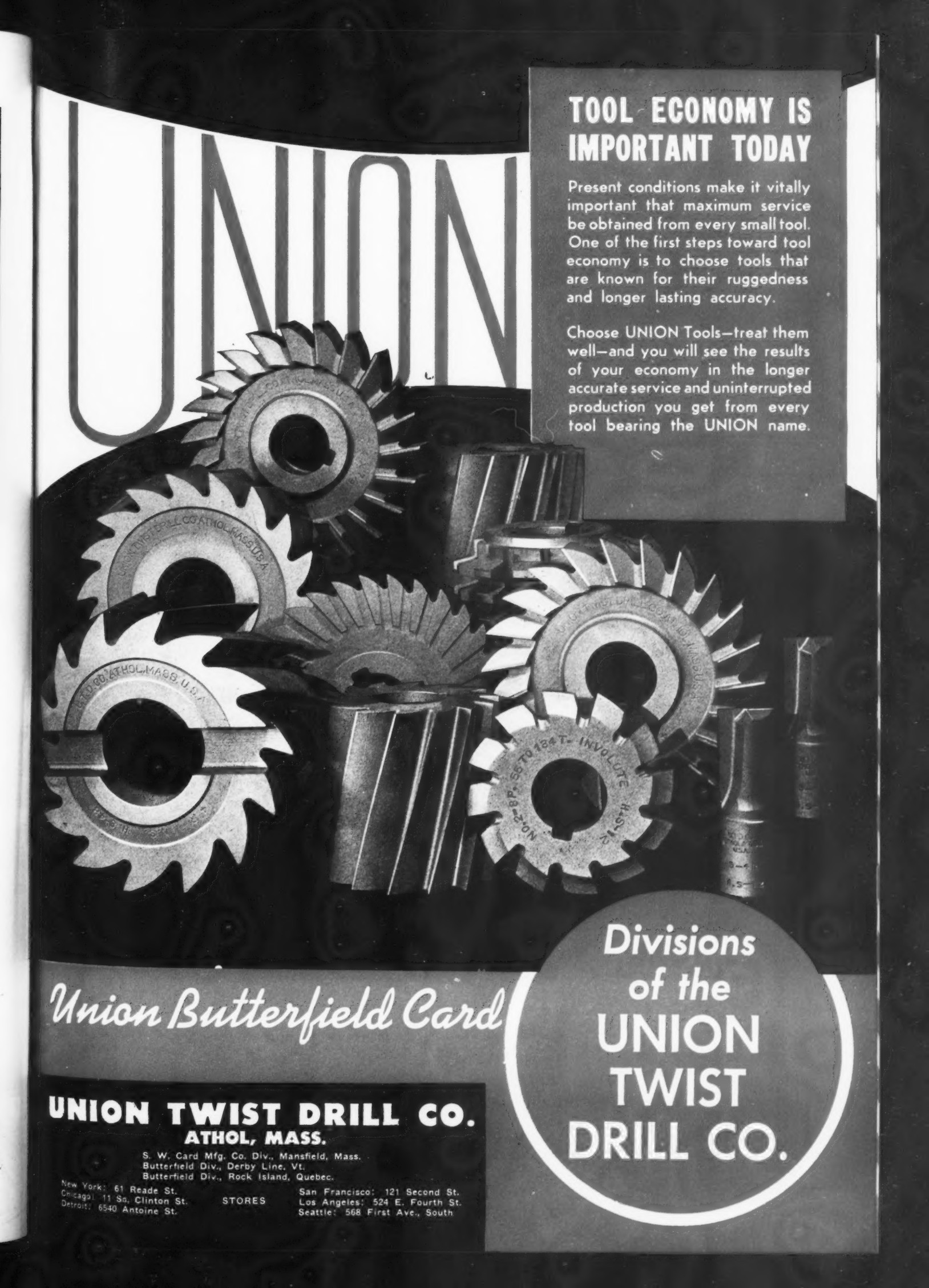
For shells, or for dozens of other flat surface jobs, GARDNER-GRINDING is simple, efficient—and FAST!

WRITE FOR BULLETIN 200B

GARDNER - GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

414 East Gardner Street , , , , Beloit, Wisconsin, U.S.A.


UNION
TOOL ECONOMY IS IMPORTANT TODAY
Present conditions make it vitally important that maximum service be obtained from every small tool. One of the first steps toward tool economy is to choose tools that are known for their ruggedness and longer lasting accuracy.
Choose UNION Tools—treat them well—and you will see the results of your economy in the longer accurate service and uninterrupted production you get from every tool bearing the UNION name.
Union Butterfield Card
Divisions of the UNION TWIST DRILL CO.
UNION TWIST DRILL CO.
ATHOL, MASS.
S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.
New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 6540 Antoine St.
STORES
San Francisco: 121 Second St.
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CARD

Get better tapping results on war production jobs! Have the Card organization show you how to get the last ounce of value from every tap you use. We can give you reliable information on every phase of thread production—preliminary drilling and reaming, correct lubrication, correct tap grinding . . . You get more than a supply of tools when you order Card Taps. You get Service that means longer tap life, better machine performance and greater efficiency.

The CARD Quality

Divisions of the UNION TWIST DRILL CO.

Union Butt

S. W. CARD MFG. CO.
MANSFIELD, MASS.

STORES

New York: 61 Reade St.
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Reamers that are **right**—for jobs that demand the utmost in precision . . . for trouble-free, tool-saving performance under heavy high production demands . . . for results that satisfy in every material, all types of work.

Choose Butterfields, and let this one great name be your guide to the right tool for every reaming job.

BUTTERFIELD DIVISION
DERBY LINE, VERMONT
ROCK ISLAND, QUEBEC

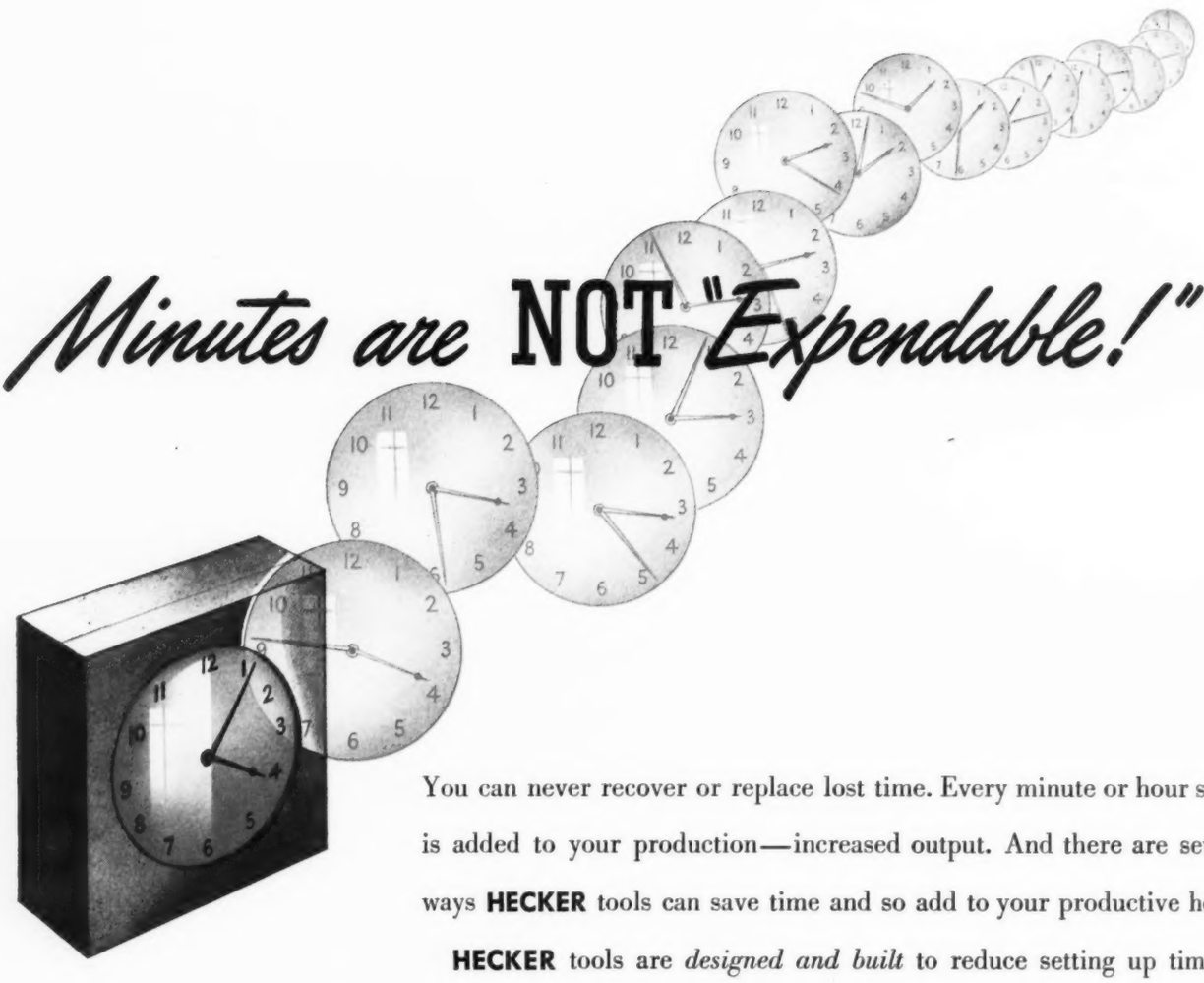
tt erfield Card

BUTTERFIELD DIVISION
DERBY LINE, VT. **ROCK ISLAND, QUE.**

STORES: New York, 61 Reade St. Chicago, 11 So. Clinton St. Cleveland, Hal W. Reynolds, 3346 Superior Ave. Detroit, 6540 Antoine St. Los Angeles, 524 E. Fourth St. Toronto, 208 King St., West. Montreal, 111 St. Paul St., West. Winnipeg, 403 Travellers Bldg. Vancouver, 327 Shelly Bldg. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S.E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

Divisions of the UNION TWIST DRILL CO.

Minutes are NOT *"Expendable!"*



You can never recover or replace lost time. Every minute or hour saved is added to your production—increased output. And there are several ways **HECKER** tools can save time and so add to your productive hours.

HECKER tools are *designed and built* to reduce setting up time, to facilitate precision work, to help inexperienced workers reach and maintain normal output and to cut the number of rejects.

Much of the extra know-how that our engineers put into every **HECKER** tool comes from constant contact with our own production work on precision parts for aircraft. This first-hand knowledge of men, machines and varied job requirements is the *plus* in **HECKER** tooling service.

Let us work out your toughest tooling problem as a demonstration of **HECKER** service. Write A. W. Hecker, 1980 East 66th Street, Cleveland, Ohio, or 517 New Center Building, Detroit, Michigan.

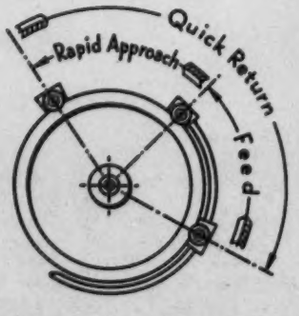
A★W★ Hecker

DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES—FABRICATORS OF AIRCRAFT PARTS

More
metal-working
PRODUCTION
IDEAS from...
Rockford

CENTER OF MACHINE TOOL PRODUCTION...

QUICKER SET-UPS FOR SHORT RUNS



Sundstrand Automatic Lathes run on cycles of rapid approach, feed, quick return of 250″ a minute. These are set up quickly and changed over easily by adjusting dogs on a graduated disc, as indicated above. No cycle control cams required.

HOW SUNDSTRAND ENGINEERED PRODUCTION CAN HELP YOU PRODUCE MORE

In addition to machine designing, our engineers are available to study and make recommendations on the most productive machining sequence. Having wide experience on production milling and turning operations makes it possible for our engineers to suggest changes which will increase production and lower cost. They are at your service without obligation. Use this service freely, especially on urgent war jobs. Be sure to send complete, accurate information with each inquiry.

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS, U.S.A. ·

SUNDSTRAND

2530 ELEVENTH STREET

MADE IN

ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

ILLINOIS, U.S.A.

Reduced

...FROM 17 MINUTES TO 7 MINUTES

on Aircraft Engine Parts

Nine different sizes of these airplane propeller shaft sleeves, each requiring a different set-up, are turned on this Sundstrand Automatic Lathe. Lots are relatively small, only 200. Yet, with the quick cycle set-up, a feature of this machine, short run work requiring different set-ups is practical and productive.

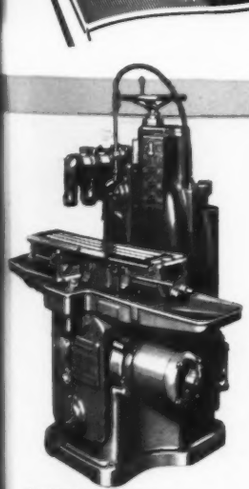
SET-UP CHANGE-OVER IN LESS THAN 30 MINUTES is possible for most operations on Sundstrand Automatic Lathes. With this feature you obtain the advantages of a fast automatic operating cycle, high rapid traverse rate of 250″ per minute and multiple tooling for your *short run work.*

EASY TO OPERATE...unskilled help can consistently produce work at close limits with a Sundstrand Lathe. The operator merely changes work pieces and starts the automatic cycle. Usually one operator can handle two or more machines.

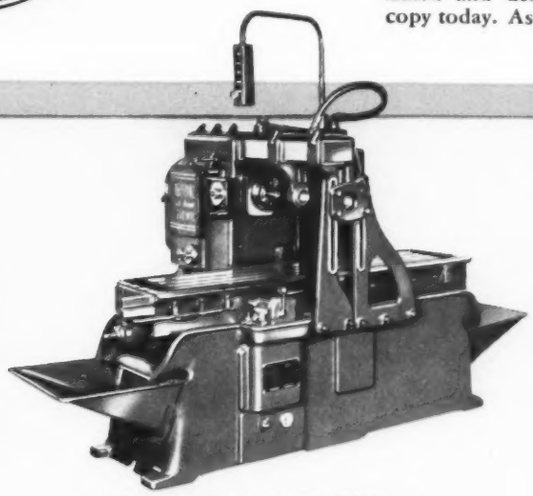
Consider these features of the Sundstrand Automatic Lathe for your short run work before investing in slower general purpose equipment. It is available in 3 models.

Because of our Engineering and Production Service to men with milling and turning problems, we have received the honor of flying the Army-Navy "E" flag. May we serve you in a similar capacity?

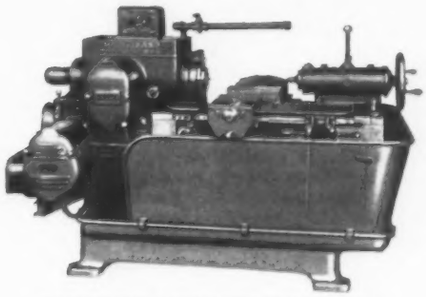
HOW TO TURN SHORT RUN WORK FASTER is illustrated in this 16-page booklet describing the features of the Sundstrand Automatic Lathes. The quick set-up and easy change-over features are described in detail. Twenty-two front and six rear carriage cycle diagrams are also illustrated and described. Write for your copy today. Ask for Bulletin No. 609.



SUNDSTRAND RIGIDMILS... AVAILABLE IN 3 SIZES



SUNSTRAND FLUID SCREW RIGIDMILS... AVAILABLE IN 3 MODELS



SUNDSTRAND AUTOMATIC STUB LATHES... AVAILABLE IN 3 SIZES

MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U. S. A.

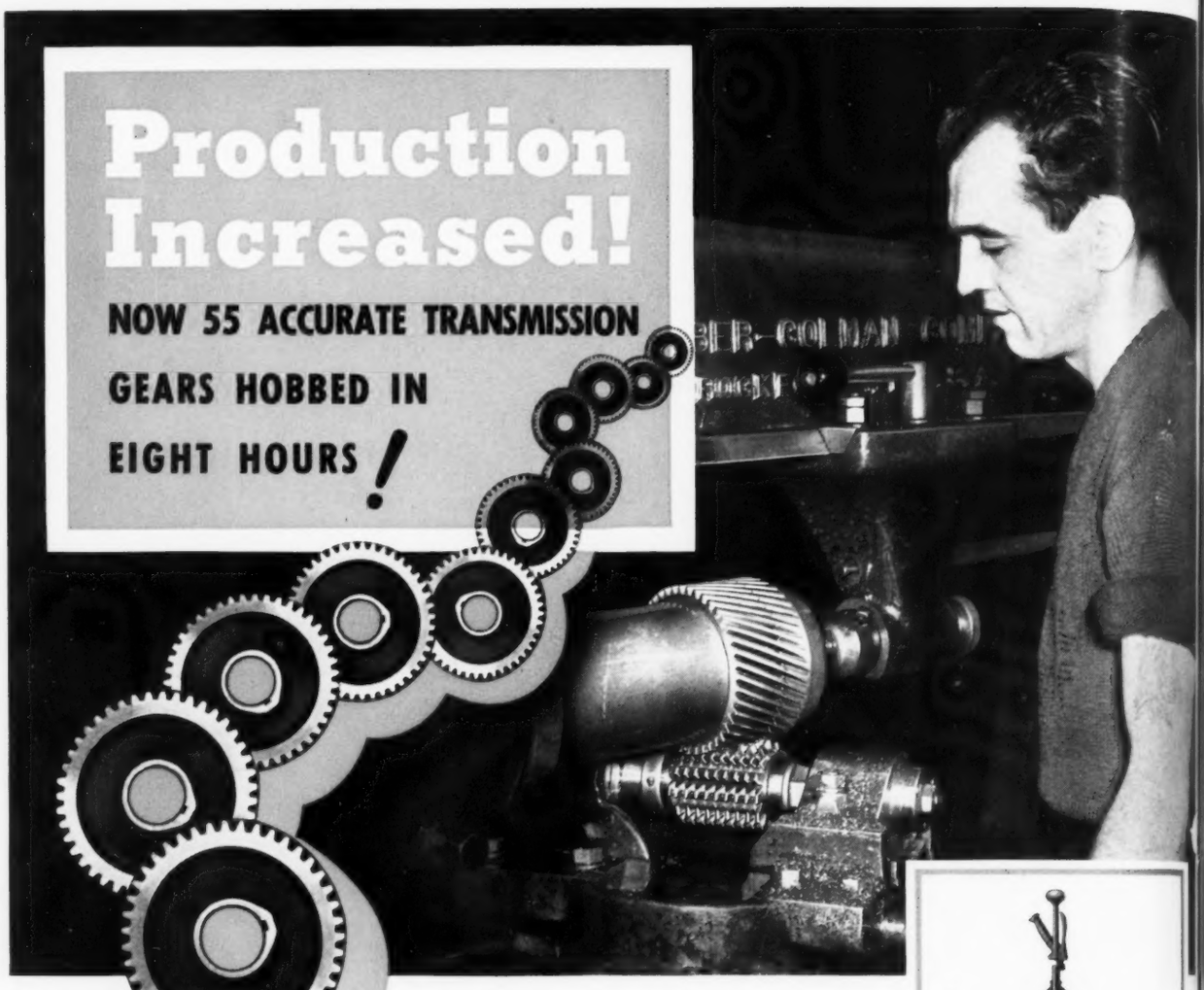
MADE IN

FOR RIGID ACCURACY IN MACHINE TOOLS... **ROCKFORD**

ILLINOIS, U.S.A.

Production Increased!

NOW 55 ACCURATE TRANSMISSION GEARS HOBBED IN EIGHT HOURS!



USE OF HEAVY-DUTY HOB SLIDE, TAPER HOLE HOBS and CLIMB HOBBING STEPS UP PRODUCTION — INCREASES ACCURACY . . . .

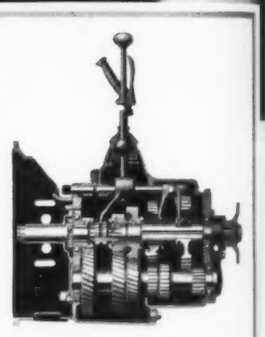
The application of a Heavy Duty Hob Slide with Taper Hob Spindle for Taper Hole Hobs to a Barber-Colman Type A Hobbing Machine has proved highly profitable for the transmission manufacturer. Now 55 helical gears, pitch 7/9 with 43 teeth are accurately hobbed in 8 hours. Climb Hobbing is used.

Heavy Duty Hob Slides permit the use of heavier feeds and higher speed to turn out a correspondingly greater production, and at the same time maintain accuracy. The hob drive shaft is larger in diameter, gear train to the hob spindle is larger and more powerful, which eliminates twist and backlash. The taper hob spindle accurately centers the taper hole hobs and reduces hob run-out error to .0001" to .0002". This results in longer hob life and more gears per hob sharpening.

If you have heavy or coarse pitch gears to cut, it will pay you to hob them on Barber-Colman Type A Hobbing Machines using a Heavy Duty Hob Slide and Taper Hole Hobs. Experienced Barber-Colman Hobbing Engineers will be glad to discuss this matter in detail with you, without obligation. Just write.

BRIEF HOB DATA

PART: Helical gear, pitch 7/9, 43 teeth, O.D. 6.358" face width 1.130" — Hob 3 per load.
MATERIAL: SAE 4620.
CUTTING METHOD: Climb Hobbing.
FEED PER REVOLUTION OF WORK: .060".
HOB SPEED: 139 r.p.m.
PRODUCTION TIME: 55 gears in 8 hours.
HOB DATA: Barber-Colman Ground Hob — 3¾" dia. x 4" long taper hole.
Hob Life: 5 settings, 100 gears per sharpening.
MACHINE: Barber-Colman Type A Hobbing Machine with Heavy Duty Hob Slide and Taper Hob Spindle.



"Fuller Heavy Duty Truck Transmission" with accurately hobbed gears provide a smooth, steady flow of power in all speeds.

FREE CATALOGS: Write for Bulletin No. 1099-3 describing Barber-Colman Type A Hobbing Machine used for General Purpose and Production applications. Bulletin F1409-1 describes special units and accessories which increase standard machine efficiency and adapt them to special applications.

BARBER-COLMAN COMPANY

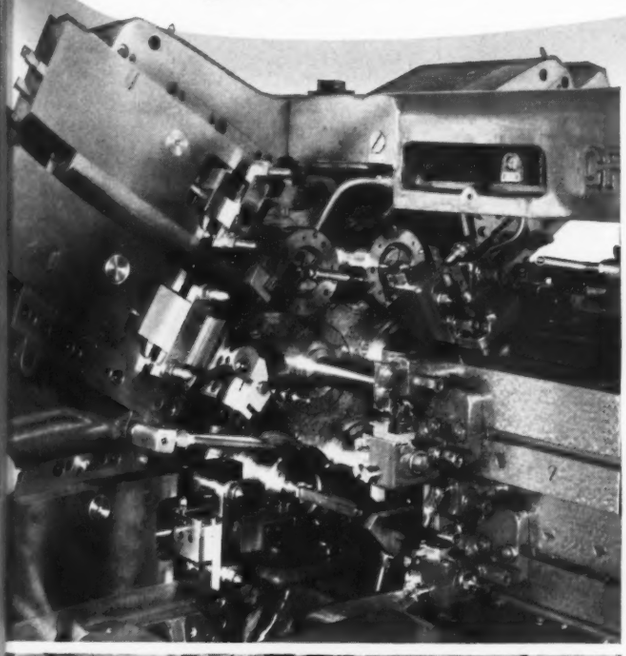
General Offices and Plant 204 Loomis Street, Rockford, Illinois, U. S. A.

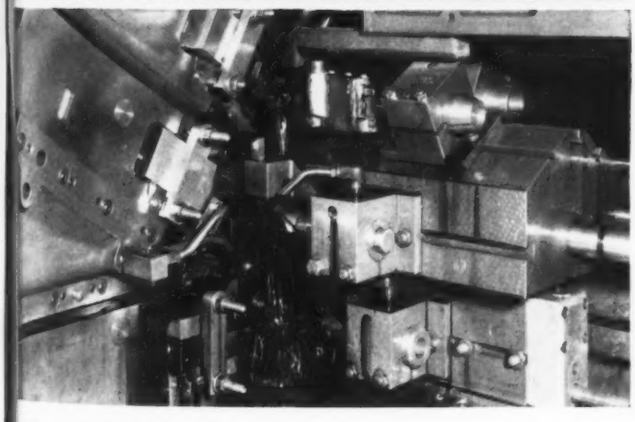
MADE IN

ROCKFORD... FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U.S.A.

THIS WIDE-OPEN TOOLING AREA ON THE GREENLEE MAKES MY JOB EASIER AND FASTER!





BUILT-IN COOLANT SYSTEM distributes the coolant through the tool and cross slides direct to the various cutting tools. The above photograph of a typical set-up on the Greenlee shows the coolant outlets in each tool holder and the easy-to-use, short nozzles.

JUST ONE OF THE REASONS OPERATORS PREFER GREENLEE SCREW MACHINES

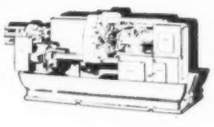
Ask the man who knows . . . the operator right out on the machine . . . and he'll tell you that the Greenlee Multiple-Spindle Screw Machine is one of the easiest machines to set up and to operate that he has ever worked on. He'll tell you that the wide-open tooling area of the Greenlee makes his work so much easier and faster because he has plenty of elbow room in making adjustments and changes. He'll also tell you that the built-in coolant system with an outlet in each tool holder permits the use of convenient, easy-to-use short nozzles to bring the coolant to each cutting tool. He'll mention how the low, compact design of the Greenlee reduces physical strain and eliminates the necessity of standing on the pan or boxes to install tooling to upper positions, and also how the positioning of the cross slides makes it easy for him to observe all cross-slide tools in action. And what's more important he'll tell you that these design features, permitting easier set-up and operation, enable him to obtain maximum efficiency and to turn out more work in a day with less fatigue.

Free Help For Your Operators

Enlarged copies of three recent Greenlee advertisements giving many valuable suggestions and production short cuts are available, without charge, for distribution to your operators. Write today for copies of (1) *14 Practical Suggestions For the Inexperienced Screw Machine Operator;* (2) *Correct Application of Cutting Fluid To Insure Longer Tool Life;* (3) *Suggestions For Changing and Adjusting Collets On Greenlee Screw Machines.*

GREENLEE BROS. & CO.

1862 MASON AVENUE • ROCKFORD, ILLINOIS

ASK THE OPERATOR  *WHO RUNS ONE . . .*

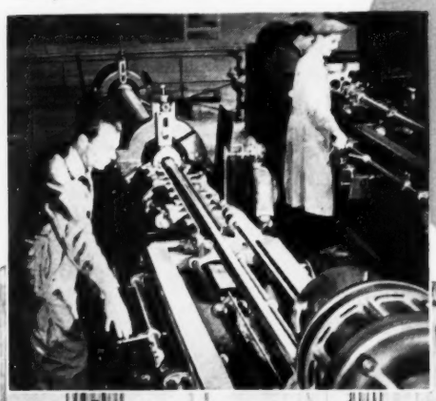
MADE IN

CENTER OF MACHINE TOOL EXCELLENCE... **ROCKFORD**

ILLINOIS, U.S.A.

HOW TO SELECT THE PROPER HONING MACHINE FOR YOUR JOB

(Inset) Partial view of an installation of **BARNESDRILL** *No. 6 Horizontal Honing Machines with 8-foot, 16-foot and 22-foot strokes respectively. Operations in photo show finish-honing the bores in gun barrels.*



(Above) Battery of **BARNESDRILL** *Vertical Honing Machines in cylinder assembly line. The nitrided barrels (hardness 1000 Vickers) are honed to limits of plus or minus 0.001" and finished to 2.5 micro-inches.*

BARNESDRILL VERTICAL HONING MACHINES are, in general, adaptable to a much wider range of applications than the horizontal type and are recommended for all honing operations that are not too long. In *addition*, vertical honers occupy less floor space.

BARNESDRILL Vertical Honers are outstanding in generating geometric low-tolerance accuracy and high finish in the bores of such cylindrical parts as cylinder blocks for airplane, automobile, tank and tractor engines; large Diesel engine cylinders; locomotive, steam, air and other cylinders; connecting rods, bushings, gear-bores and many other machine parts. We also build honers adapted to honing external diameters.

BARNESDRILL Vertical Honers will handle a full range of work extremes from 0.30" to more than 30" in diameter with lengths up to 90".

BARNESDRILL HORIZONTAL HONING MACHINES provide the essential accuracy and finish required on all caliber cannon and the largest naval guns; also on tubing, oil well working barrels, etc. Special horizontals can be furnished for external honing of long piston rods and shafting.

BARNESDRILL Horizontal Honers are available in a number of models to handle a large variety of work. The world's largest internal honing machine is a product of the Barnes Drill Co. It has a 76-foot spindle stroke and will hone diameters up to 41". The over-all length of the machine, including work support bed, is 184 feet. Longer honers can also be furnished if needed.

BARNESDRILL COMBINATION BORING AND HONING MACHINE, both vertical and horizontal, are designed for plants in which production on reboring and honing operations is not sufficient to warrant installation of a single purpose machine. These combination machines provide an ample range of reboring and subsequent honing facilities on the same machine and will handle medium sized production, reconditioning and maintenance work to excellent advantage.

BARNESDRILL engineers will be glad to recommend the proper type and model of honing machine for your specific production requirements. Send blueprints of parts for analysis and suggestions. There is no obligation.

FREE HONING DATA: Write today for valuable book containing complete description of the honing process with data and specifications covering the entire line of **BARNESDRILL** Honing Machines. Ask for Bulletin No. M.

Barnes Drill Co.

814 CHESTNUT STREET
ROCKFORD
ILLINOIS, U.S.A.

MADE IN

ROCKFORD ... **FOR ACCURATE, FAST METAL REMOVAL**

ILLINOIS, U.S.A.

GRINDING TIME CUT IN ½ with MATTISON GRINDERS

28 Gears per table load . . compared to 6

4 Lathe Slides per table load . . . compared to 1

SET-UP SHEETS

Containing complete information regarding these and similar jobs will be sent upon request.

4 TIMES AS MANY SMALL PARTS PER LOAD BECAUSE OF GREATER GRINDING AREA

At the Sundstrand Machine Tool Company, grinding time on small parts has been cut in half with their Mattison High-Powered Precision Surface Grinder. One reason for this substantial saving in grinding time is the greater load and grinding area of their Mattison Grinder. To illustrate — gear parts shown on the above machine were formerly ground 6 pieces per load. With the Mattison Grinder, 28 pieces are ground simultaneously. Similarly the Lathe Slides were formerly ground one at a time. With the Mattison — 4 pieces can be held in the grinding area. Both of these jobs are held to within limits of a few tenths. On numerous other small parts similar results are obtained. Double column construction for the wheel slide assembly and other construction features enable users of Mattison Surface Grinders to get repeated precision results on a high production basis. Machines are offered in a wide variety of sizes to meet every requirement from 12" to 36" wide by 36" to 192" long. Write for the free Set-Up Book, containing further examples, showing how others have reduced time and increased production with Mattison Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

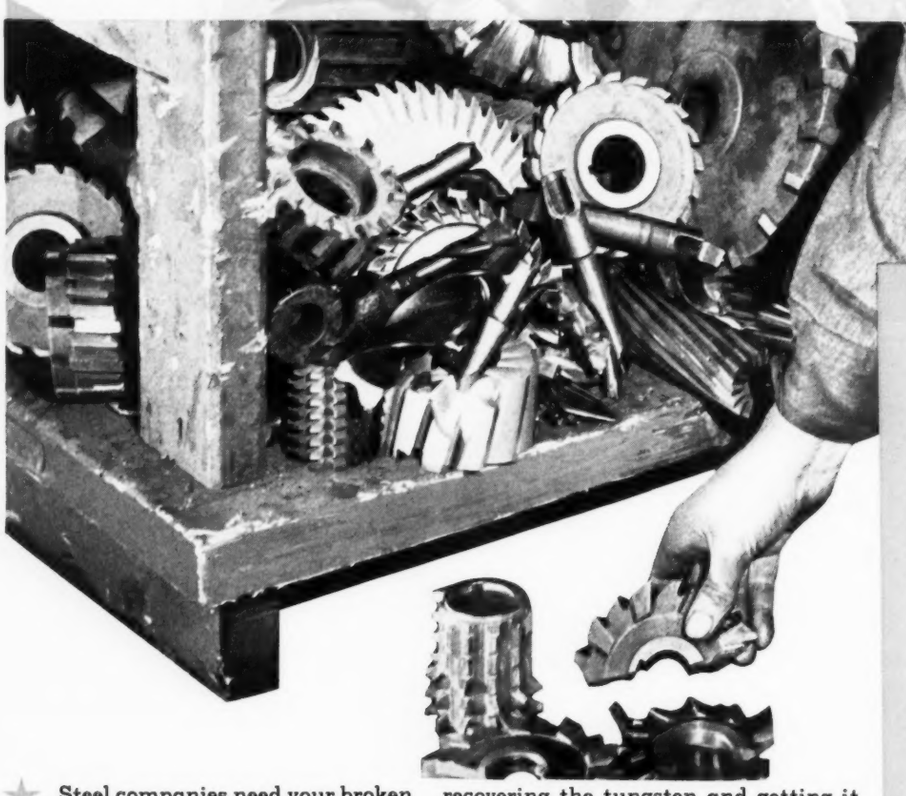
MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN . . . **ROCKFORD**

ILLINOIS, U.S.A.

the answer
to YOUR Delayed Cutter Order May Be Here . . .

HELP SPEED THE MANUFACTURE AND DELIVERY OF HIGH-SPEED STEEL CUTTERS BY TURNING IN THIS VALUABLE SCRAP



★ Steel companies need your broken and scrapped cutters. They need them in order to recover the tungsten and use it in increasing the supply of High Speed Steel.

Since a good portion of our country's tungsten supply has been diverted to other war needs, you, as a cutter user, can help the situation by turning in all broken and worn out tools. Even new tools, not to be used for the duration, should be placed in the hands of manufacturers who can use them, or turned in to the steel companies for recovering the tungsten and getting it back in metal working production.

HOW TO DO IT

Go through your plant. You'll probably find a quantity of broken or obsolete High Speed Steel milling cutters, drills, reamers, hobs and other cutting tools under benches or out-of-the-way places. Have them packed and shipped to your steel company. You'll help the situation materially. You'll better the delivery on your present or next cutter order. *Do it today,* please.

HOW TO SHARPEN AND TAKE CARE OF YOUR MULTIPLE THREAD MILLING CUTTERS

This valuable 16-page booklet has been prepared to clarify some of the problems connected with the use of thread milling cutters under war time conditions. It contains useful and practical information for the proper care and sharpening of multiple thread milling cutters.

Valuable data and information such as causes of chatter, how to remedy chatter, how to avoid taper, and other useful hints and suggestions are included. Write for your copy today. Ask for booklet No. F1926.

FREE

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 204 Loomis Street, Rockford, Illinois, U. S. A.

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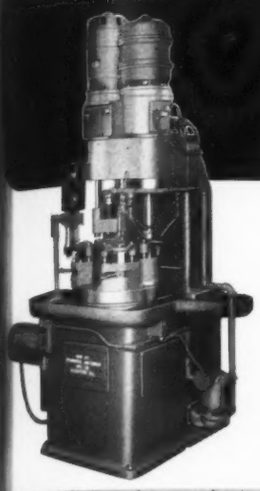
ROCKFORD ... MACHINE TOOL SHOPPING CENTER

ILLINOIS, U. S. A.

Rehnberg-Jacobson
ORDNANCE MACHINES

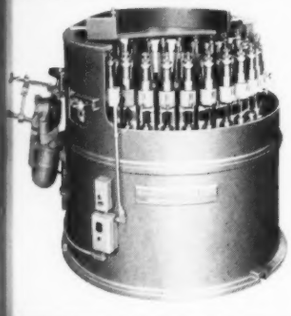


SHOT CAP MACHINE

This four-position, two-spindle vertical machine performs the finishing operations on 37 mm. A.P. Shot Caps. The first spindle completely finishes the top profile of the cap, including the point and undercut, with an inserted-blade hollow milling tool. The second spindle automatically threads the cap, using a chaser-type die head with a precision ground lead screw.

180 PER HR.

Capacity of this machine is 180 pieces per hour, requiring one operator to load and unload the work at the two front stations. Proper synchronization of operations is obtained with suitable interlock. Illustration shows unfinished and finished cap.

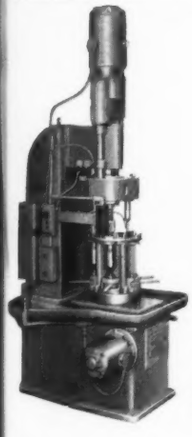


SOLDER WIPING MACHINE

This machine assembles shot and cap with a wiped solder joint, excess solder being removed by a brush. Operation is continuous and automatic, the wiping action providing a firm joint with exclusion of all air bubbles and oxidation. The machine requires about six feet by seven feet of floor space and has two motors totalling 5 horsepower.

1200 PER HR.

Capacity of this machine is 1200 assemblies per hour. Three operators are required—one to load the shot, one to load the cap, and one to remove the completed assemblies. Illustration shows the cap and shot separate, and the assembled unit.

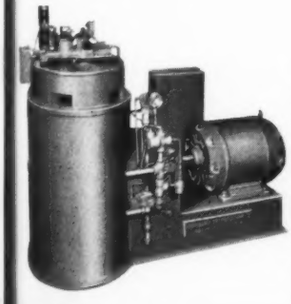


TRACER HOLE MACHINE

This is a five-station, vertical, automatic-indexing machine for drilling, reaming, and countersinking the tracer hole in 75, 57, 40, or 37 mm. A.P. shot. The sequence of operations is (1) Unload and load, (2) Drill half way, (3) Drill from half way to depth, (4) Ream to depth, and (5) Countersink. The drilling is done in two steps to increase production and reduce drill breakage and wear. The reaming spindle has individual feed to give it twice the travel of the drilling spindles. One machine can, with minor modifications in the fixtures, be used for any of the four sizes of shot listed above.

240 PER HR.

Capacity of this machine is 240 holes per hour. One operator is required, to load and unload the work. All operations are fully automatic and properly interlocked for protection. Illustration shows a 75 mm. shot before and after the tracer hole is drilled.



SHELL BANDING MACHINE

This machine squeezes the band onto the shot and will handle shot from 20 mm. to 75 mm. size at various production rates depending on the number of squeezes necessary to give a thorough penetration of the band into the serrations. When more than one squeeze is used, the piece is indexed between squeezes to permit uniform metal flow and prevent crystallization. Pressure can be regulated to suit a variety of conditions.

600-1200 PER HR.

Capacity of this machine is 1200 20 mm. shot or 600 37 mm. shot per hour. One operator is required, to drop the shot and band into the "nest". Illustration shows shot and band, and the assembly.

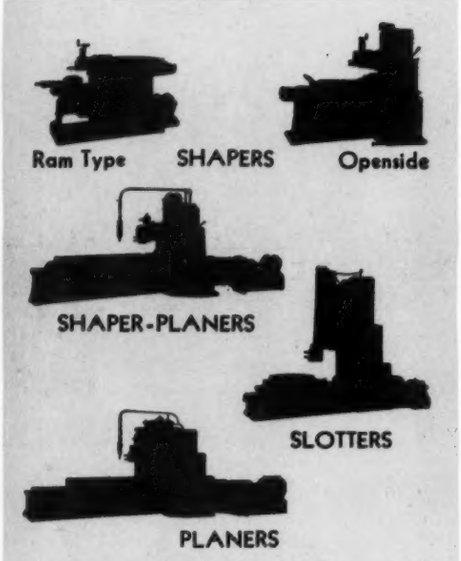
REHNBERG-JACOBSON MANUFACTURING CO.
Special Machinery
2137 KISHWAUKEE ST. ROCKFORD, ILLINOIS

R-J
REHNBERG JACOBSON

MADE IN
ROCKFORD MADE MEANS PRECISION MADE... ROCKFORD
ILLINOIS, U.S.A.

Making EVERY MINUTE COUNT

AND- Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right



Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right

Throughout our plant willing hands are building Hy-Draulic Machine Tools as fast as it can be done right so that orders received *now* can be delivered promptly according to official priorities.

☆Walk through the shop any day or night — after establishing identity right down to your birth-mark, if any. But keep moving, and don't bother anybody. The place is full of earnest workers, grimly intent on making every minute count in building Hy-Draulic Machine Tools as fast as it can be done right. ☆All on high-urgency orders, Hy-Draulic Machine Tools are required for vital war work because they can make every second of every minute count. Their hydraulic drives and feeds get the last ounce out of cutting tools, make it easy for operators to produce maximum quantities of highly accurate, finely finished work every shift. ☆The 36″ Openside Hy-Draulic Shaper and the Hy-Draulic Shaper-Planer are especially useful in handling a raft of work that makes the biggest ram-type shapers say "Uncle", yet can't be done as economically on other machines. ☆Note: Peace-time features and advantages, that create increased demand for Hy-Draulic Machine Tools on war work, will be even more valuable in the peace that follows Victory.

Hy-Draulic
Reg. U. S. Pat. Off.

Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

MADE IN

ROCKFORD... CITY OF MACHINE TOOL SPECIALISTS

ILLINOIS, U.S.A.

STANDARD MACHINE + SPECIAL AIRCRAFT PART = Production Plus

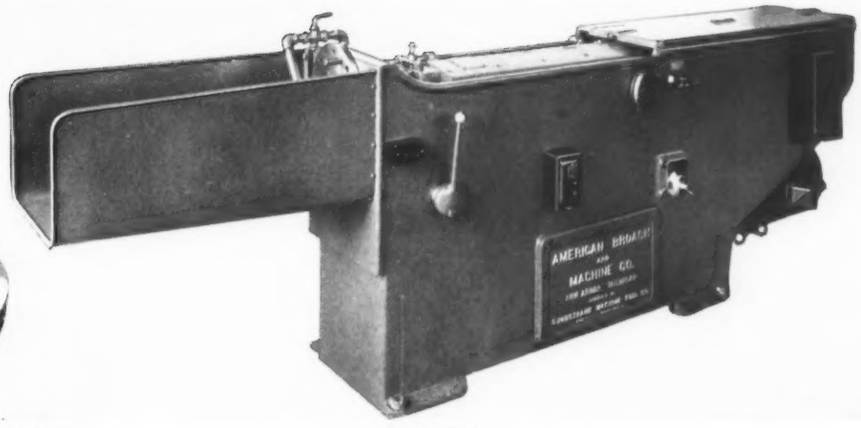


FIGURE 3

FIGURE 1

Using a *standard* machine, aircraft bearing cage openings are broached—two cages at a time. Production and finish are both excellent—but that is only part of the story!

FIGURE 1 shows the *standard* American horizontal broaching machine used for this *specialized* job. FIGURE 2 shows the fixture, designed by American broaching engineers to adapt the machine to the job. Two bearing cages are loaded side by side. Broaches are connected and pulled through two openings in each cage. After indexing, the operation is repeated until both cages are finished. FIGURE 3 shows one cage drilled and reamed prior to broaching; the other is a finished part.

Wherever possible, American recommends standard machines even for very special armament work. The result is faster delivery, greater economy, easy and quick conversion to peacetime products when the war is won.

BROACHING IS BETTER

THE *American* WAY

FIGURE 2

★ *American*

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S... ROCKFORD

ILLINOIS, U.S.A.

Production Doubled

...ON SHRINK FIT ASSEMBLY OF AIRPLANE LANDING STRUTS!

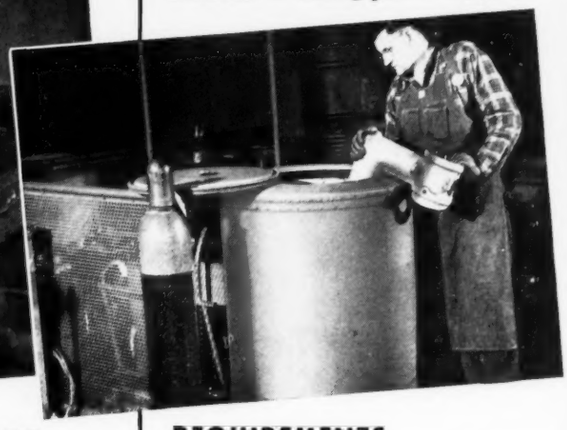
COMPANY NAMES STARTING WITH C*

increased production

Case Study from the Files of Deepfreeze

The Sub-Zero Method of Shrinking, Testing and Treating of Metals

**Name on request to bona-fide inquiries*



Data and Part Information

Shrink-fit assembly of aircraft landing struts.

Diameter of bore—4.843" ± .002".

Diameter of mating part—4.843".

Deepfreeze metal chilling assures permanent assembly —reduces cost

These airplane landing struts, requiring a permanent shrink-fit, were formerly assembled in 20 minutes including heating time. This was done by heating the female part only.

With the installation of a Deepfreeze Cascade Industrial Unit, in conjunction with heating, the time has been reduced to 10 minutes—rejects minimized.

HOW IT'S DONE

The female part is heated in an oil bath at 450° F. and expanded .005". The male part is shrunk .003" in a Deepfreeze Cascade —120° F. Chilling Unit. The time in oil bath is 5 minutes—time in Deepfreeze 5 minutes. The cooling time to room temperature, in a jig, is 5 minutes—total 10 minutes. They are then inspected and wheel spindle must indicate within .003".

HOW DEEPFREEZE CAN HELP YOU... Deepfreeze sub-zero temperatures (as low as —120° F.) can help you in any one or all three of the following metal working operations:

1—Shrinking of metals for ease of bearing assembly, etc.

2—Testing of metals for reaction of sub-zero temperatures to aircraft instruments, etc.

3—Treating of metals for preventing growth or warp in gauges, etc.

FREE Additional Data *and proof of the outstanding success of the Deepfreeze method for chilling metals are included in this booklet. Write for your copy today.*

REQUIREMENTS

To obtain a *permanent* shrink-fit assembly of airplane landing struts.

DIFFICULTIES

Former method by heat only, unsatisfactory—could not hold even temperature. Too many rejects requiring pulling apart or disassembly.

Other Difficulties . . .

Dry ice was too costly, took too much time to crack and prepare...would not handle present production requirements.

SOLUTION

The Deepfreeze Cascade —120° F. Unit used in combination with an oil bath for mating part, meets every requirement, doubles production.

SAVINGS

In addition to savings in time, new method saves approximately $30.00 per day—cost of dry ice.

Deepfreeze

DIVISION

MOTOR PRODUCTS CORPORATION

2313 DAVIS ST., NORTH CHICAGO, ILLINOIS

SWITCH TO NE STEELS
...with Assurance

Jominy End-Quench Hardenability Testing in Ryerson Lab. All NE Alloy Steels are tested before they are accepted for stock and check tests are conducted to assure accuracy of results. This data is passed on to customers with each shipment.

NE Alloys in Ryerson Stocks
Write for New Booklet

New Technical data — including heat treatment response—is available on NE (National Emergency) Steels. Ryerson tests all NE Steels in stock. This test information is furnished with each shipment of that particular NE Steel. Thus, users can choose which of the lean-alloy steels will best replace the steels of high alloy content previously used.

Jominy End-Quench Hardenability Tests, standard for NE Steels, are a quick, reliable method of determining heat treatment response. How this test is made, the results obtained, and how to interpret hardenability in terms of tensile strength, yield point, elongation, and reduction of area, are clearly told in a recent Ryerson publication on NE Steels. Copies are available—call or write your nearby Ryerson plant.

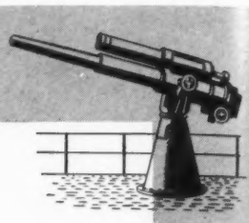
Representative stocks of NE Steels are available at Ryerson for prompt shipment. Turnover is rapid; withdrawals are heavy, but new stocks are constantly being received. Ryerson engineers and metallurgists will gladly answer any question you may have and help you get started with NE Steels.

JOSEPH T. RYERSON & SON, INC.
CHICAGO • MILWAUKEE • ST. LOUIS
CINCINNATI • DETROIT • CLEVELAND
BUFFALO • BOSTON • PHILADELPHIA
JERSEY CITY

★ ★ ★

A HANDBOOK ON NE STEELS
New, complete, authoritative! Compiled by Ryerson. If you are adapting NE Steels to your production and haven't a copy, ask for one today!

RYERSON STEEL-SERVICE



CRAMP DELIVERED

54,000,000 lb

OF CASTINGS DURING

1942

★

CRAMP PROMISES EVEN GREATER TONNAGE IN

1943

IF MATERIAL IS AVAILABLE

BLW THE BALDWIN GROUP

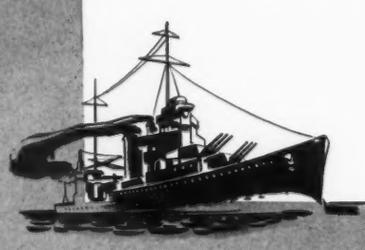
CRAMP

BRASS & IRON FOUNDRIES

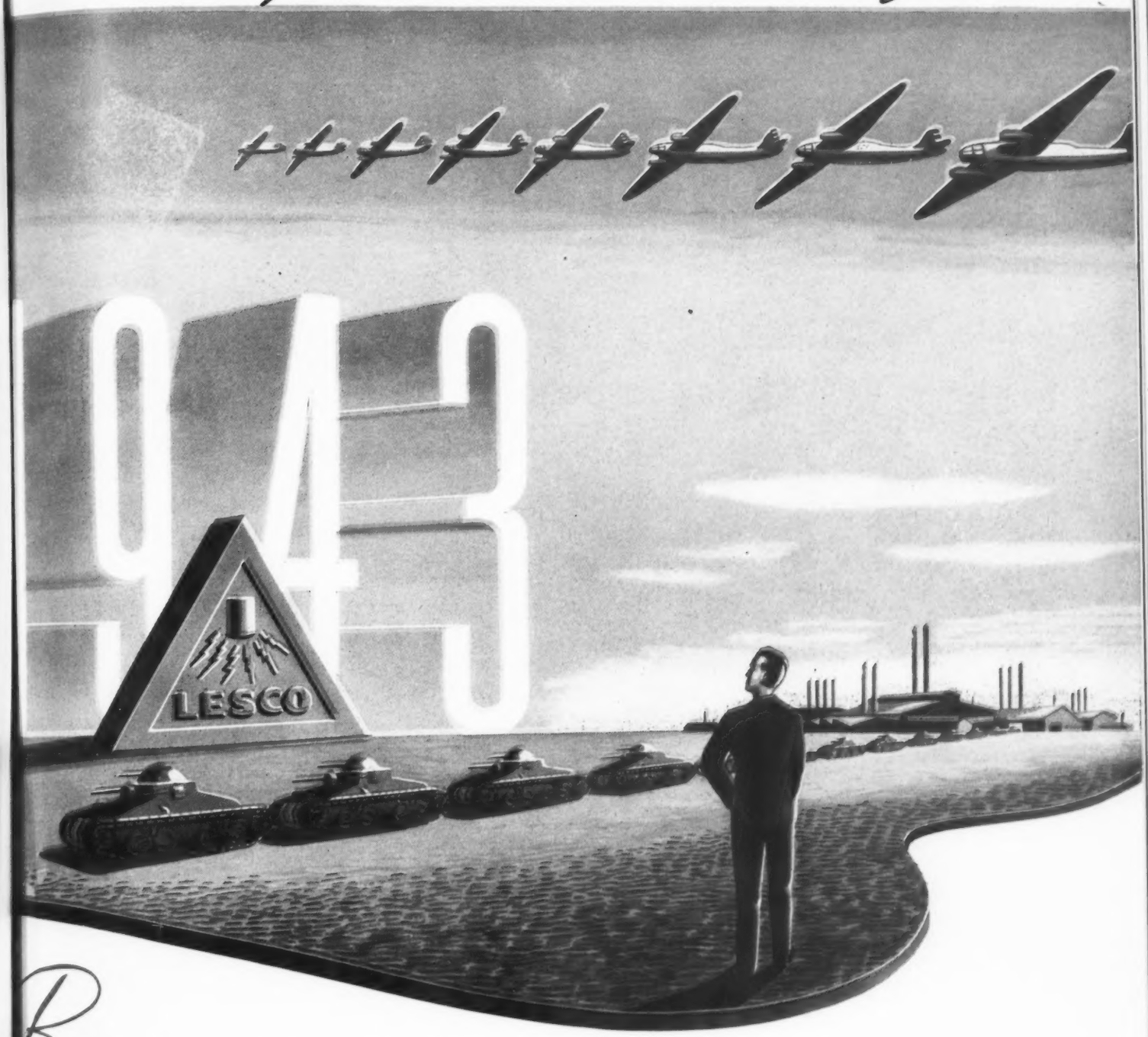
DIVISION OF THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

NEW YORK • SAN FRANCISCO • CLEVELAND • NEW ORLEANS



A new year ... a renewed faith



BEFORE us lies a new twelve months . . . a milestone in history which, we hope, will guide us to a fuller realization of America's way of life.

And to the extent that manpower and machinery and munitions co-ordinate, to that extent will the path to Victory be made secure.

Latrobe, in line with Industry everywhere, dedicates this coming year to a renewed faith in American ideals and a renewed effort to maintain maximum production. Backed by traditional quality, Latrobe's trademark symbolizes in the months that lie ahead, as it has in the past, dependable tool steels for the essential tools of Victory!

HIGH-SPEED STEELS *FOR THE* TOOLS OF VICTORY

LATROBE

ELECTRIC STEEL COMPANY

LATROBE • • • PENNSYLVANIA

JOHNSON UNIVERSAL BRONZE

KEEP WHEELS TURNING *FASTER···LONGER*

Wartime production demands full efficiency in every motive unit. This calls for the best in bearing bronze. To gain the longest bearing life . . . to cut replacements to a minimum...to keep wheels turning FASTER...LONGER—install Johnson UNIVERSAL Bronze. Your local distributor has a stock on hand.

JOHNSON BRONZE COMPANY
520 S. MILL STREET
NEW CASTLE, PA.

Call your
LOCAL
DISTRIBUTOR

OWI Photo by Palmer, in an Allegheny Ludlum Plant

GRAY... *and Skilled*...

IN THE SERVICE OF STAINLESS STEEL

THE production of alloy steels is essentially a matter of technique. Many of them are complex, metallurgically; and all of them are compounded to a nicety and processed to specific requirements of surface finish and physical properties.

More often than not, the ability to produce these alloy steels successfully to such close limits, and the added ability to multiply the tonnage many times under the necessities of war, come as a result of having developed the *original* technique. The accumulated knowledge and experience of the mill technicians and men who developed an idea into a special steel, and shouldered the trials of pioneering it commercially, make all the difference.

For Allegheny Ludlum, that is true in the cases of stainless steel, gasoline engine valve steel, and many alloys for electrical purposes. It is true also of certain tool and die steels, notably the DBL High Speed Steel analysis, which has replaced "18-4-1" on the majority of the nation's production jobs.

These steels of our development are among the most vital of the war. We want to place our "know-how" completely at your disposal, to help you select them wisely and use them well, without waste. • Call on us for technical and fabricating data, or for the help of our Technical Staff.

ADDRESS DEPT. M

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: BRACKENRIDGE, PA.

A-8747 . . . W & D

Free book on Tool Steel and its Treatment

Here's a new book that will be of practical value to anyone who works with tool steel. It's called *Tool Steel Treaters' Guide* and is a "how-to" manual from start to finish.

You'll find in it specific information on how to forge, normalize, anneal, spheroidize, cool and harden tool steel. You'll find many clear, informative photographs on quenching, P-F fracture standards, hot-acid etching, and grain structure. Also, there are two full-color charts showing the actual heat and temper colors of steel, through the heating and tempering ranges.

One section of the book is devoted to definitions of some of the terms used in the steel industry—hundreds of items are defined, ranging from "Air-Hardening Steel" to "Yield Strength." These definitions should be particularly helpful to new men in war-production jobs involving the handling of steel.

Another feature of the *Tool Steel Treaters' Guide* is its section of useful tables: weights and areas of square and round bars; weight per linear foot of flat bar steel; areas and weights of different shapes of steel bars; Brinell hardness numerals; hardness-conversion tables; temperature-conversion tables; revolutions per minute for assigned surface speeds; English-metric system equivalents.

Anyone who works with tool steel will find the 116 pages of the Tool Steel Treaters' Guide *packed with usable information. The guide will gladly be furnished free of charge to anyone who is engaged in war production. Write to Bethlehem Steel Company, Bethlehem, Pa., for a copy today.*

A Few of the Subjects Covered: NORMALIZING • ANNEALING • TEMPERING • QUENCHING MEDIA • MICROPHOTOGRAPHS OF HIGH-SPEED STEELS • HEAT AND TEMPER COLOR CHARTS • DEFINITIONS OF STEEL INDUSTRY TERMS • WEIGHTS OF STEEL BARS • FARENHEIT-CENTIGRADE • CONVERSION TABLES • DECIMAL EQUIVALENTS OF AN INCH FOR EACH 64TH.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

DOW

The winged ingot is a symbol of freedom—graphic expression of Dow's recovery of magnesium, lightest of light metals, from sea water to release airplanes from hampering weight. When peace returns this symbol will reach full significance. Millions of pounds of Dow magnesium—also facilities for fabricating Dowmetal castings and wrought products—will speed transportation and lighten innumerable industrial and domestic tasks.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

PRODUCER OF THE LIGHTEST OF LIGHT METALS SINCE 1916

MAGNESIUM

INGOT • CASTINGS • FORGINGS • SHEET • STRIP • PLATE • EXTRUSIONS

STELLITE HIGH-PRODUCTION CUTTING TOOLS *are Available for Prompt Delivery*

Stellite "98M2" and "Star-J-Metal" tools are widely used for machining steel, cast iron, and most of the machinable materials. These dependable tools take heavy cuts at high speeds and heavy feeds—with long life between grinds. This means high production at low cost per piece machined.

The types and sizes in which each grade is available, the purposes for which each type is recommended, and the correct grinding wheels to use are shown in the descriptive price lists illustrated below. Copies of any of these price lists will be sent on request.

Stellite "98M2" tools (left) were developed specifically for machining steel, and are also excellent tools for use on brass, bronze, and cast iron. They are hard, tough, and possess good edge strength.

Stellite Star-J-Metal Tools (right) are used on many materials, including steel and cast iron, for a wide variety of operations—including turning, boring, facing, milling, reaming, grooving and forming.

Standard Tools in Stock

SOLID TOOL BITS—Square, flat, or round . . . wide range of sizes . . . finish-ground ready for use in standard tool holders. Easily converted to various profiles.

WELDED TIP TOOLS—A variety of styles and sizes for use where solid bits are impracticable.

MILLING CUTTER BLADES—For many cutter body types, including Ingersoll, Kearney & Trecker, Modern, Production, OK, and Continental.

WEAR STRIPS—Haynes Stellite alloy castings brazed to a mild steel base, for attachment to boring, driving, and pilot bars to assure accuracy and long life.

Special Tools to Users' Specifications

Many types of special Stellite tools are regularly supplied, cast and finish-ground to users' specifications. These include solid bits, welded tip tools, milling cutter blades, reamer blades, brazed-in blade shell end mills, form tools, boring tools, counterbores, spotfacers, and reamers.

STELLITE
Reg. U. S. Pat. Off.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

The words "Haynes Stellite," and "Stellite" are registered trade-marks.

ONE WORD

6 doz. HACK SAW BLADES Made of *Ingersoll* D-B-L STEEL

INGERSOLL D-B-L

(Tungsten . . . . . 5.00-6.00)
(Molybdenum . . 4.00-5.00)

The remarkable performance of Ingersoll D-B-L . . . its relative freedom from decarburization . . . its tough cutting quality and its high impact resistance . . . plus its lower cost, have made it a wartime favorite.

Only INGERSOLL has had 4 YEARS EXPERIENCE

in producing this Lower Cost Type of High Speed Steel for Hack Saw Blades

Specify *Ingersoll* D-B-L, on its 4-year record of past performance.

INGERSOLL SPECIAL STEELS *FOR SPECIAL USES*

Alloy Steels
Armor Plate
Clutch Plate Steels

Tillage Steels
Soft Center Steels
Shovel Steels

Knife Steels
TEM-CROSS Steel
IngAclad (Stainless-Clad Steel)

Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

THE MOST IMPORTANT CONTRIBUTION TO METAL CUTTING SINCE THE ADVENT OF CARBIDE

FULLY PROVEN—EFFECTIVE UP TO CARBIDE CUTTING RANGE—NOT A SUBSTITUTE FOR CARBIDES—USE WHERE YOU CANNOT USE CARBIDES

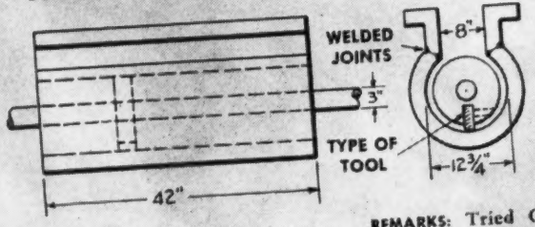
What Is TANTUNG? Tantung is a hard, tough, non-ferrous alloy. Its red hardness is far above that of any steel. It is strong and tough and unlike other non-ferrous cutting alloys, Tantung contains tantalum carbide. This adds materially to hardness and imparts a self-lubricating action which minimizes chip wear or "cratering."

What TANTUNG Does? Tantung cuts rolled, forged or cast steel, cast iron, aluminum, brass, copper, bronze or any material that can be machined.

Increased Machine Productivity! Under most conditions Tantung tools operate at double the speeds recommended for high speed steel. Tantung permits heavier cuts, heavier feeds, more pieces per grind. All these factors contribute to doubling and trebling production on boring, turning, and facing operations.

Change to TANTUNG! It is easy to change to Tantung tools from high speed steel. Standard tools are available which fit most tool posts and holders, and no special grinding equipment and wheels are necessary. The conventional HSS tool practices apply to the effective application of Tantung tools.

A SPECIFIC EXAMPLE OF TANTUNG TOOL PERFORMANCE



SOLID TOOL BIT (⅝" bit in boring head).
MATERIAL—18-8 Stainless Steel and welded joints.
MACHINE—20-year-old Lucas Boring Machine.
ADVANTAGE OF TANTUNG—Unable to keep any other tool from breaking at the welded joint.

	TANTUNG Rough	TANTUNG Finish	OTHER CUTTING MATERIALS
S.F.M.	240	346	All other tools tried failed by breaking at the welded seam after only a few revolutions.
Feed/Rev.	14	40	
Depth of cut	⅛	.010	
Pieces per grind	1	1	

REMARKS: Tried Carbides, H.S.S., and a competing cast alloy and got nowhere in a day and a half. Tantung tool bit completed the job in 3 hours, with a mirror-like finish.

FREE—*SEND FOR TANTUNG PERFORMANCE DATA BOOK*

TANTUNG • ECONOMY • ALL PURPOSE • CUTTING OFF • SPECIAL TOOLS • SOLID TOOL BITS • MILLING CUTTER BLADES

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS • DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES
IN CANADA: **Carbide Tool & Die Company, Ltd., Hamilton, Ont.**

434

ARISTOLOY STAINLESS

ONE OF THE FAMILY OF ARISTOLOY STEELS

To conserve nickel and chromium, all industry is cooperating to limit the use of stainless steels to vital applications where only stainless will do the job. For such applications Copperweld Steel Company is furnishing Aristoloy Stainless steel bars and billets. We'll be glad to discuss your stainless steel applications with your engineering staff.

COPPERWELD STEEL COMPANY WARREN, OHIO

...a steel knot

ACTUAL PHOTOGRAPH
Speed Case Steel (.20 carbon) 1-inch cold drawn bar tied in a knot, cold, without fracture.

SPEED CASE - SPEED TREAT STEELS

Your steel problem may not include tying knots in open hearth free machining steel, but Speed Case and Speed Treat Steels have solved many knotty problems involving production bottlenecks for many of the nation's largest war producers.

These two steels, employing no strategic alloys, have often reduced machining costs over 50% and doubled production. If your engineering department is not familiar with these steels, our metallurgists will be glad to assist them.

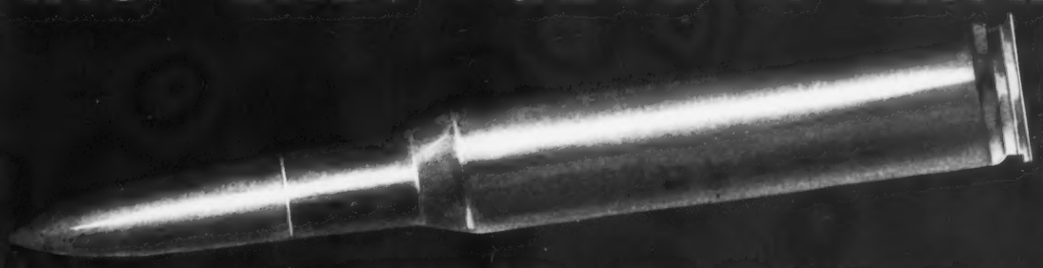
MONARCH STEEL CO.
THE FITZSIMONS CO.
PECKOVER'S LTD., TORONTO, CANADIAN DISTRIBUTOR

INDIANAPOLIS
HAMMOND, CHICAGO

LICENSEE FOR EASTERN STATES
YOUNGSTOWN, OHIO

...MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

THIS "BABY" GETS 17 BATHS



That Help *SPEED-UP* Production and *INCREASE* Output!

This is a cal. .50 machine gun cartridge designed to shred aircraft armor, strafe landing barge personnel, find the vitals of reconnaissance cars and scythe down advancing infantry.

It will take a lot of these to win the Victory and it takes over 70 operations to make each one... to form and assemble its case, its primer with cup, pellet and anvil, its bullet with point, core and jacket. Between these and other operations are 17 cleaning jobs... not just cleaning to wash away dirt and metal chips but also, to remove a variety of drawing, forming and cutting oils, compounds and greases. The cleaning has to be THOROUGH. It has to be FAST.

This essential production degreasing is a typical example of Oakite War-Time Service to Ordnance Munitions makers. For many we have solved other difficult problems, in some cases setting up over-all individual plant techniques of specialized time-and-man-power-saving cleaning operations.

CAN YOU USE THIS VALUABLE FREE SERVICE?

If, in your plant, there is a cleaning operation suspected of being less thorough than it should be or of taking even a few more seconds time than necessary, let a nearby Oakite Technical Service Representative take a helpful look at the situation. His FREE services... a contribution to the Nation's war effort... are yours for the asking. Write today!

A FEW OF MANY CASES WHERE OAKITE MATERIALS AND METHODS ARE BEING USED TO SPEED-UP PRODUCTION OF ORDNANCE AND MUNITIONS

STEEL SHELLS: *Removing machining oils, soluble cutting and grinding oils, graphite, heat treat scale, shop dirt and smut. Neutralizing after scale removal. Rust-proofing after boring, cold nosing, scale removal, grinding and cleaning. Cleaning before re-loading, removing acid-proof paint, red lead, oxide, grease and rust.*

STEEL DEPTH BOMBS: *Removing anti-rust, blanking oil, light rust and welding scale.*

TORPEDO CASINGS: *Removing quenching oil and heat treat scale. Rust-proofing prior to shipping for assembly.*

STEEL BURSTER TUBES: *Removing slushing oil and rust.*

BRASS BURSTER CASES AND FUSE PARTS: *Removing lard oil, metal chips and discoloration.*

BRASS CARTRIDGE CASES: *Forming with Oakite Special Drawing Compound. Removing drawing compound, heat treat scale and pickling acids.*

ALUMINUM BOOSTER CAPS: *Removing lard oil.*

STEEL INCENDIARY BOMB CASES: *Removing silver soldering flux, oxides, heat scale, rust and discoloration.*

CARTRIDGES: *Removing blanking paste, lard oil, soap tallow, and soap from brass cases and bullet jackets.*

GUN BARRELS: *Removing burned on powder after test firing.*

LANDING FIELD STEEL MATS: *Stamping steel sheets with Oakite Special Drawing Compound.*

STEEL BOOSTER CAPS: *Reverse Current Degreasing before zinc plating.*

RIFLE PARTS: *Electrocleaning Method of removing oil and burned powder after practice firing.*

ANTI-AIRCRAFT SHELL CASES: *Removing machining oil, castor oil, soap and drawing compound.*

Manufactured only by

OAKITE PRODUCTS, INC., 26 Thames Street, NEW YORK, N. Y.

Representatives in All Principal Cities of the United States and Canada

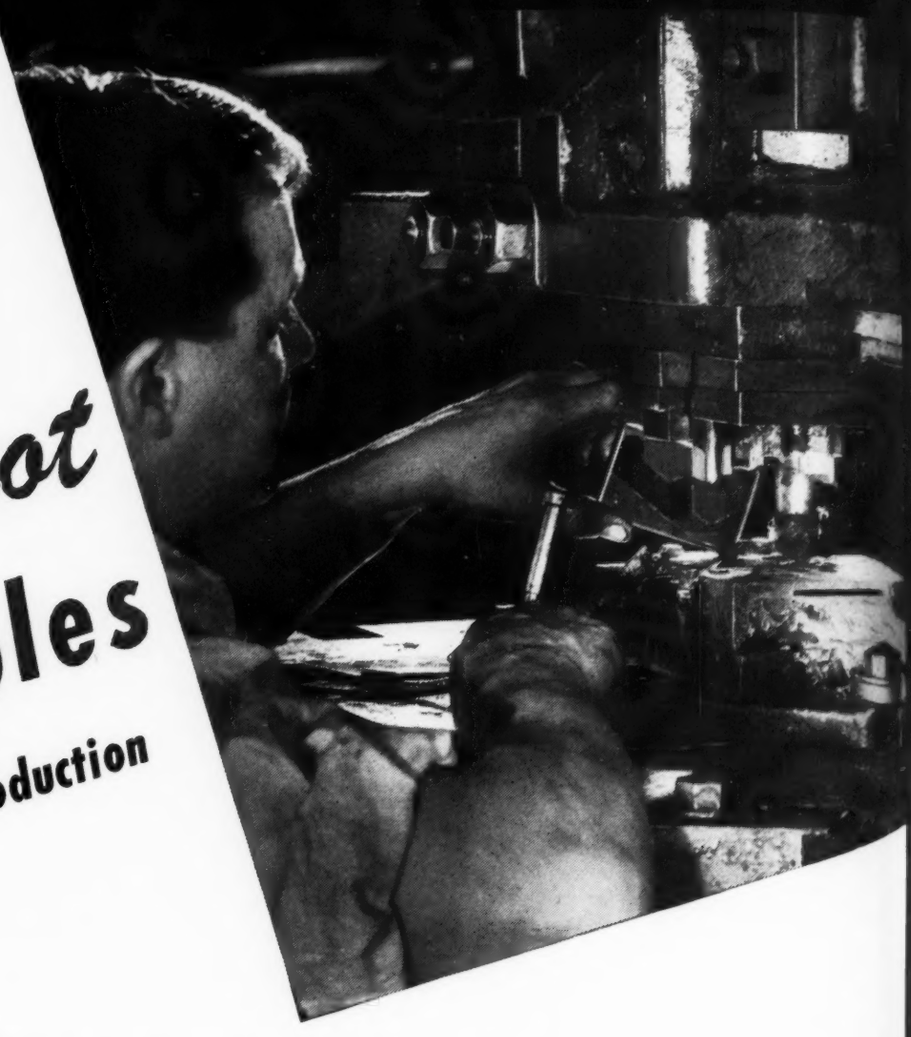
OAKITE CLEANING

MATERIALS...METHODS...SERVICE

FOR EVERY CLEANING REQUIREMENT

How to spot tool troubles

that interfere with production



Just when everything is humming on the production line — wham! — a vital die or tool that had performed perfectly a moment before lets go. Quickly a hand reaches for the switch to cut off power — and a valuable production unit stands idle.

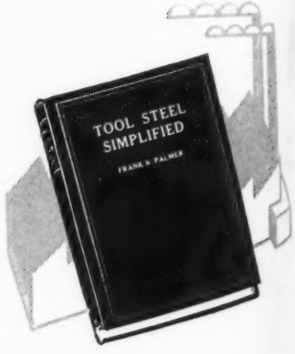
Such sudden interruptions — even short ones — are the bugbear of war-sped production lines. What happened? What went wrong? How can it be corrected?

This may help you find the Answer...

"Trouble shooting" tool failures—how to find what's wrong and correct it—how to spot tools that might *look* all right, but may cause unnecessary shut-downs—are discussed in Chapter 18 of "Tool Steel Simplified". Photographs of tools that failed in service are shown. You are told *why* they failed, *how* their failure could have been *prevented*—how to prevent many tool troubles.

But the chapter on "trouble shooting" is only one of many ways in which "Tool Steel Simplified" brings you helpful, practical information that you can use to prevent premature tool failures. Chapter after chapter, subject after subject, it gives the sort of down-to-earth working data you can put to use to get better tool performance, longer production runs. It covers tool steel selection, tool making, heat treating, quenching, furnace atmosphere, testing—the whole tool steel picture—in easy-to-read everyday shop language.

You can start right here to see how useful "Tool Steel Simplified" is—how helpful it can be as a handbook for use in your shop or tool room. See the opposite page.



More than 35,500 copies of "Tool Steel Simplified" are now being used in plants like yours to train new men, "up-grade" older hands, save time, trouble shoot—get better and faster production.

The Carpenter Steel Company, 105 Bern St., Reading, Pa.

How to "trouble shoot" tool failures

The term "trouble shooting" has been aptly applied to the business of trying to find out why something went wrong. A good trouble shooter must be open minded and unprejudiced. He cannot first make up his mind what he "hopes" the trouble is—and then set out to prove he is right. Furthermore, he must be well informed on his subject. Possession of the knowledge contained in "Tool Steel Simplified" would automatically make a tool maker a reasonably good trouble shooter on tool failures. Discussed below are a few of the tips contained in the chapter on trouble shooting.

Spalling in Service—Tools like header dies, coining dies, striking dies and embossing dies which are under heavy pressure must usually be made from a surface hardening tool steel. If they are made from a tool steel that hardens clear through, they are likely to split—they need the reenforcement of a tough core in order to hold together. If the hardened case is *too shallow* for the pressures involved, it will cave in like thin ice. This sinking action frequently progresses slowly — but eventually a chip will come loose and this is known as spalling. An example is shown in Figure 1.

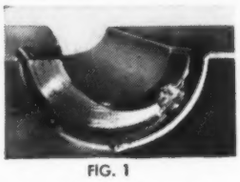


FIG. 1

The remedy for this is to use a higher hardening heat, or a flush quench, or both, to drive the hardness penetration deeper. Failing in this, use a steel having slightly deeper hardening characteristics.

Heat Checks—In the red-hard tool steels used for hot forming operations, the working surface of the tool will frequently become crazed with a pattern that is suggestive of grinding checks. When a tool is in contact with the heated work, it is suddenly heated. If a liquid coolant is used, the minute the hot forging is removed the surface is rapidly chilled. This process is repeated many times and finally the surface starts to heat check. A badly checked hot drawing mandrel is shown in Figure 2.

FIG. 2

Heat checking can be greatly helped by not employing so violent a coolant. A stream of water can be replaced by an air blast. Also, a tool that has been drawn back far enough to have some ductility will resist heat checking better than a harder tool.

Grinding Checks—Grinding checks so fine that they cannot be seen with the naked eye can so weaken a tool that it may later fail in service. Figure 3 shows a tool with grinding checks that has been boiled in acid to make them visible. If this tool were to fail as a result of grinding checks, the edge of the fracture would follow the path of some of the checks. This makes a characteristic jagged edge to the fracture which should immediately suggest grinding checks. Boiling the tool in acid will make them visible.

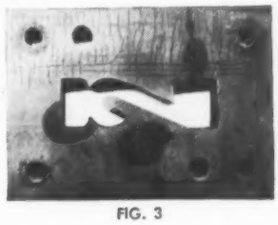


FIG. 3

Obviously, all grinding checks are not the fault of the grinder. If he receives a poorly hardened and poorly drawn tool that is almost ready to fall apart when he gets it, he cannot grind it successfully, no matter how careful he may be. On the other hand, it is so easy to hog into the work on the roughing cuts that many good tools are ruined in grinding.

Note: In trouble shooting, never anneal a failed tool for hot acid inspection or any other purpose until all necessary investigations have been made in the hardened condition. Much valuable evidence may be lost in the anneal.

Machining—It is well to be suspicious of tools from which large amounts of metal have been cut, and those that have deep, sharp stamp marks. In case of doubt, it is better to be on the safe side and give such tools a strain relieving anneal before hardening them. Figure 4 shows a pneumatic chisel that failed in service from fatigue that started in a deep stamp mark.

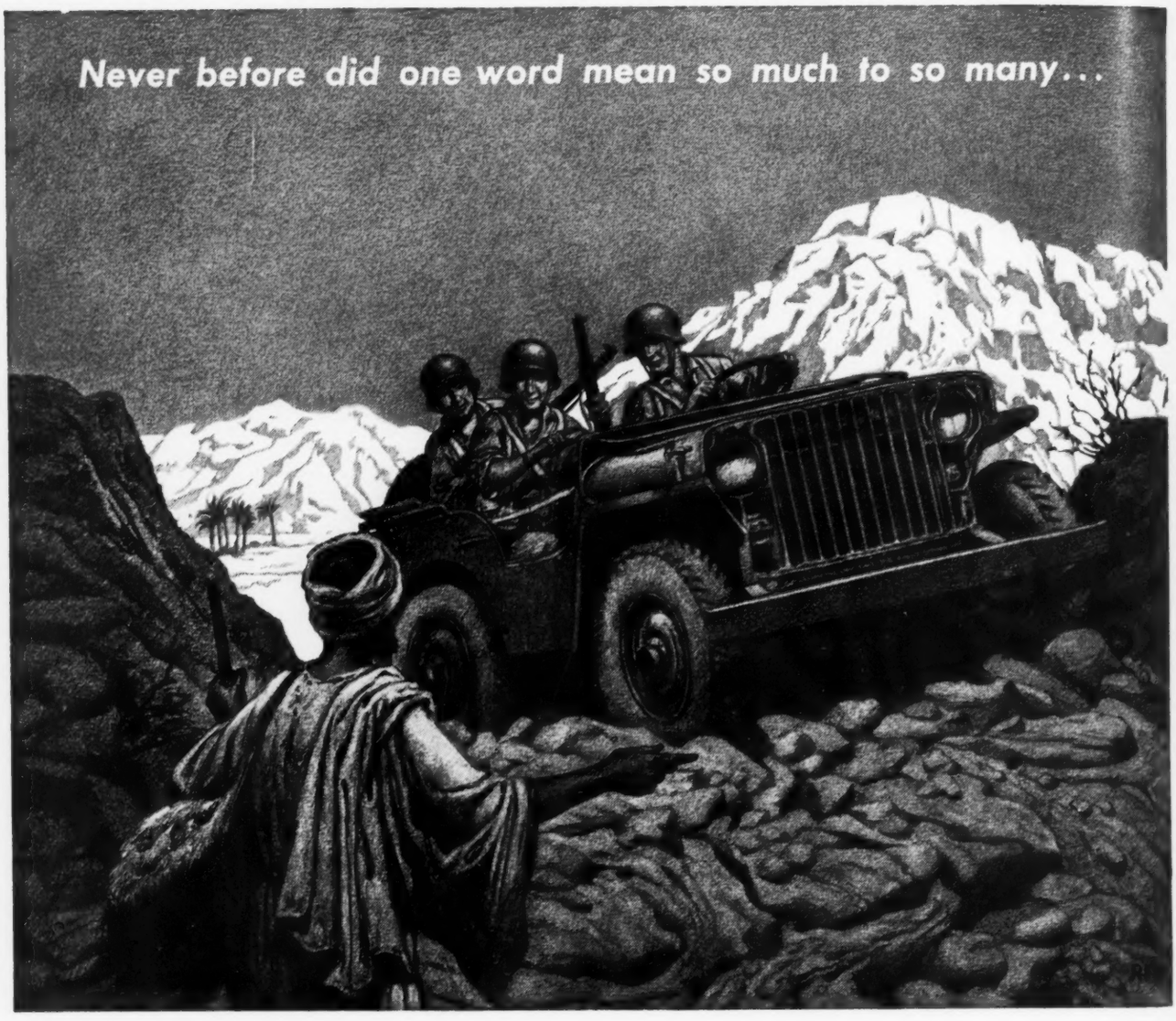
FIG. 4

"Tool Steel Simplified" 315 pages, 205 illustrations. Available at cost in the U.S.A.—$1.00 a copy ($3.50 elsewhere).

This is only part of the information contained in *one* chapter of "Tool Steel Simplified". Put *all* its useful facts on many subjects to work for *you*—right in your tool room. Order copies for the tool room men you want to train—for your "trouble shooters"—today.

Carpenter MATCHED TOOL STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia



You can serve by CONSERVING

Name a continent... and you've named an American battlefront. From Tunisia to Timor, from India to Iceland, Americans and their Allies face a need for more arms and equipment... more tanks and trucks, more planes and ships and guns.

And those modern weapons need alloy steels in vital parts. Nickel steels, for example, that provide extra toughness, strength and added resistance to shock and impact. No need to tell you how essential these qualities are to the equipment of our armed forces.

That's why it's so important to *conserve* critical alloys. Every possible pound must be saved for our fighting men.

The best way to help is by making sure all metal scrap in your plant is properly segregated. Collect ferrous and non-ferrous scrap, in separate containers, at the machines where generated.

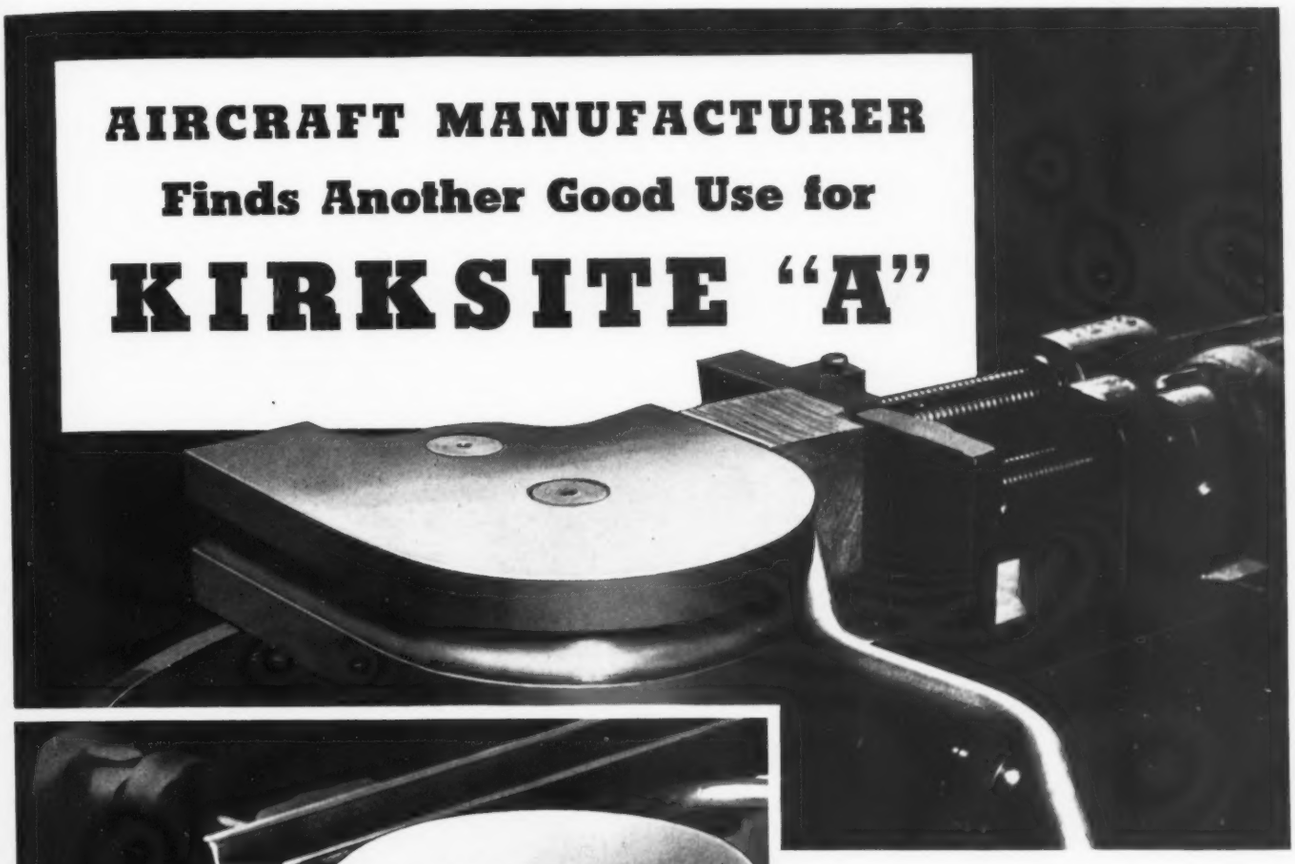
High-speed tool steels and alloyed constructional steels should also be collected and salvaged separately. When in doubt... segregate!

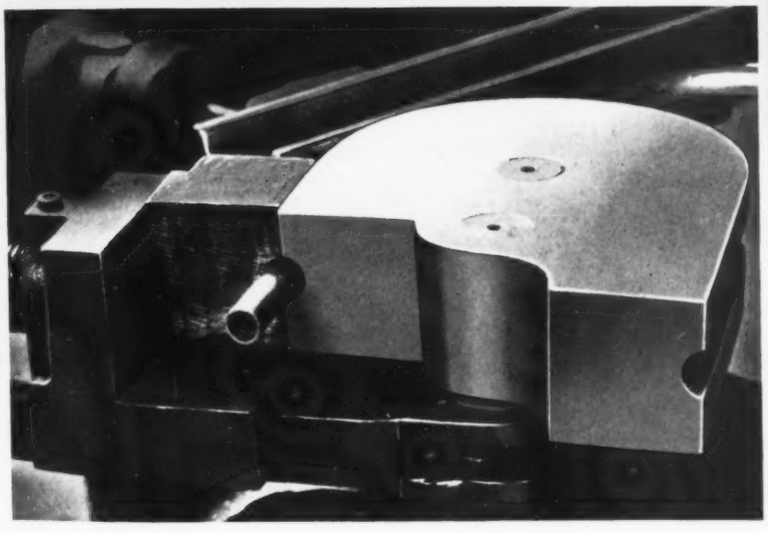
If metal problems are bothering you—if you would like suggestions for extending your own metal conservation program—call on our technical staff for "CONSERVICE,"—a new name for counsel and data that will help you conserve.

★ ★ **Nickel** ★ ★

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

AIRCRAFT MANUFACTURER
Finds Another Good Use for
KIRKSITE "A"

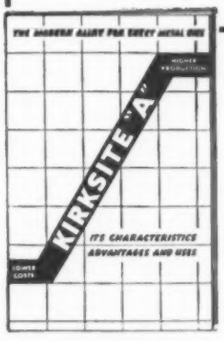




The unique metallurgical structure of Kirksite "A" makes it ideal for many applications in addition to its regular use as a superior metal for blanking and forming dies. Above is shown the way in which the Rohr Aircraft Corporation, Chula Vista, Calif., uses Kirksite "A" for radius blocks used in bending gas and oil pressure lines. Because Kirksite "A" can be accurately sand-cast and requires little machining, these blocks are produced quickly. The total time-savings are considerable, since a great many blocks are needed for bending aluminum alloy or steel tubing of all sizes from 3/8" to 2" O.D. to radii from 1 7/8" to 5". Production records of one Kirksite block show that it has bent many hundreds of parts made of .049" x 1 1/2" tubing without showing appreciable wear. These factors—the speed with which they can be made and their exceptional wearing qualities, make the cost of Kirksite "A" blocks at least 50 per cent less than that of cast iron.

KIRKSITE "A" IS NOW A WAR METAL

The entire output of Kirksite "A" metal is required at the present time to meet the demand of vital war industries. Therefore the purpose of this advertisement is merely to call to the attention of future users the characteristics of this new alloy, against the time when the many unique advantages of Kirksite "A" will be available to all.



Send for our new Booklet K that will give you all the necessary details about the working qualities of Kirksite "A". You will want to keep it for future reference.

NATIONAL LEAD CO., 111 Broadway, New York, N. Y.

Branches in all Important Manufacturing Centers

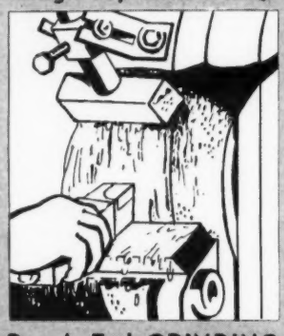
CORRECT TOOL HANDLING *Increases Production*

RULE 2

USE CARE IN ROUGH GRINDING
KENNAMETAL* TOOLS

ROUGH GRINDING KENNAMETAL TOOLS

Rough Top GRINDING



Rough End GRINDING

Rough Side GRINDING

ROUGH GRINDING

Rapid grinding is possible on large green or grey grit special loose bond silicon carbide wheels, using a water coolant with enough sal soda to make an alkaline solution and prevent rusting of the machine. A 60-grit soft bond wheel of as large a diameter as possible should be used. A 20-inch diameter wheel is preferred for the usual run of large tools such as are used in machining shells and other armament.

The coolant should cover the entire working face of the wheel and make contact with the wheel just above the tool. A spur wheel dresser should be used frequently to keep the new silicon carbide crystals exposed. An experienced operator can keep the wheel dressed, with the tool being ground, by maintaining a constant movement of the tool back and forth across the wheel as well as rocking the tool in both directions. A fairly heavy pressure should be used in order to break the silicon carbide crystals and thus maintain a free cutting wheel.

Light pressure merely dulls the wheel and causes a sudden local generation of heat in the tip or steel shank. The flow of water, hardness of the wheel bond, and other grinding conditions should be such that the tool, pulled rapidly away from the wheel while grinding, should not feel warm when touched with the finger.

To permit rocking the tool in all directions during the roughing operation, a narrow tool rest (approximately 1½ inches) should be used. This rest may be set at an angle about 2° to 3° more than the clearance angle required, thus permitting a final pass over the wheel with the tool held on the rest, to true up the angles for finished grinding.

*INVENTED AND MANUFACTURED IN U. S. A.

KENNAMETAL THE All American CARBIDE

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147 LLOYD AVE., LATROBE, PA.

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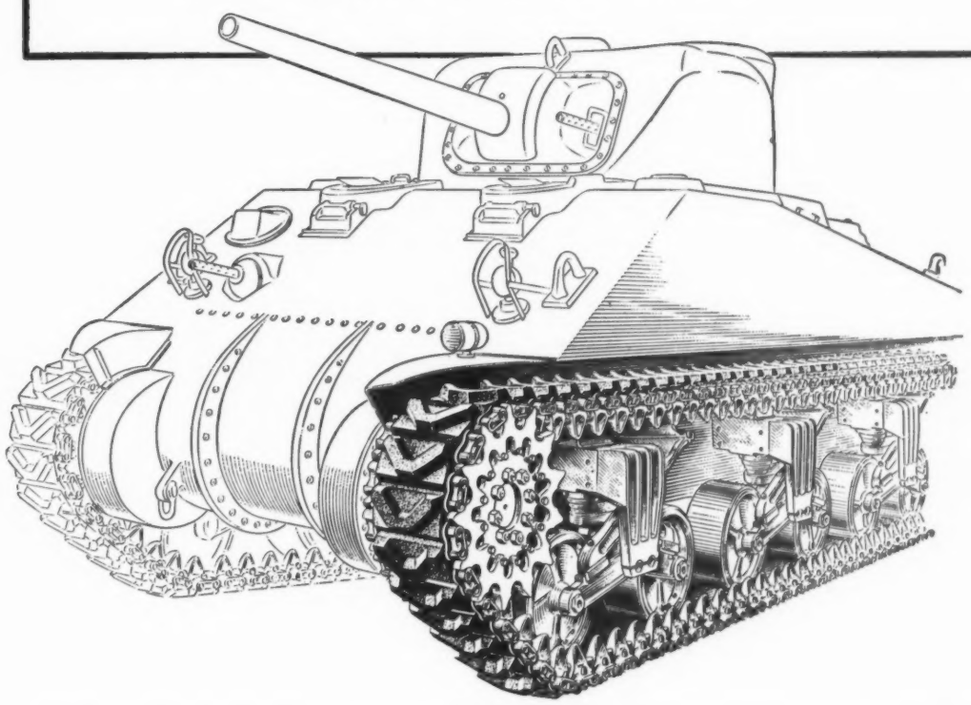
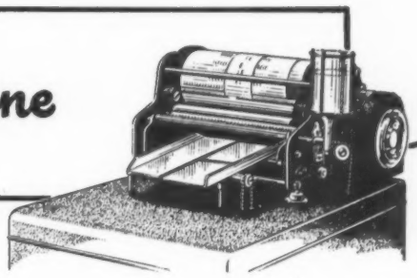
the Tank took a hint from



the Duplicating Machine



THERE'S NO maintenance man in most offices, making regular trips with a grease gun to see that bearings have plenty of lubrication. That's one of the reasons why builders of business machines selected the Torrington Needle Bearing to lengthen the service life of their products.

With Army tanks, of course, it's entirely different. They're regularly and thoroughly inspected by highly skilled maintenance crews. But when a tank comes back from the battlefield, and the crew starts racing against time to get it ready for another lightning dash against the enemy, there's a big advantage in having bearings that seldom need attention. So the tank designers, like the business machine builders, turned to the Torrington Needle Bearing because its high load capacity helps prevent overloading or breakdowns, because its simple, effective system of lubrication allows the bearing to run for long periods without *any* attention at all. And its ready availability helps speed the job of tank production.

WHEN YOU PLAN YOUR POST-WAR DESIGNS, here's something to think about. Your peacetime customers will probably be looking for products that last longer, need less attention, work more efficiently—and the Needle Bearing can help you give them what they want. You will find a long list of typical Needle Bearing applications in Catalog No. 111. One of them may give you an idea for your own product—and Torrington engineers will be glad to help you work out the details.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Connecticut, U. S. A.

Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit
Cleveland Seattle Chicago San Francisco
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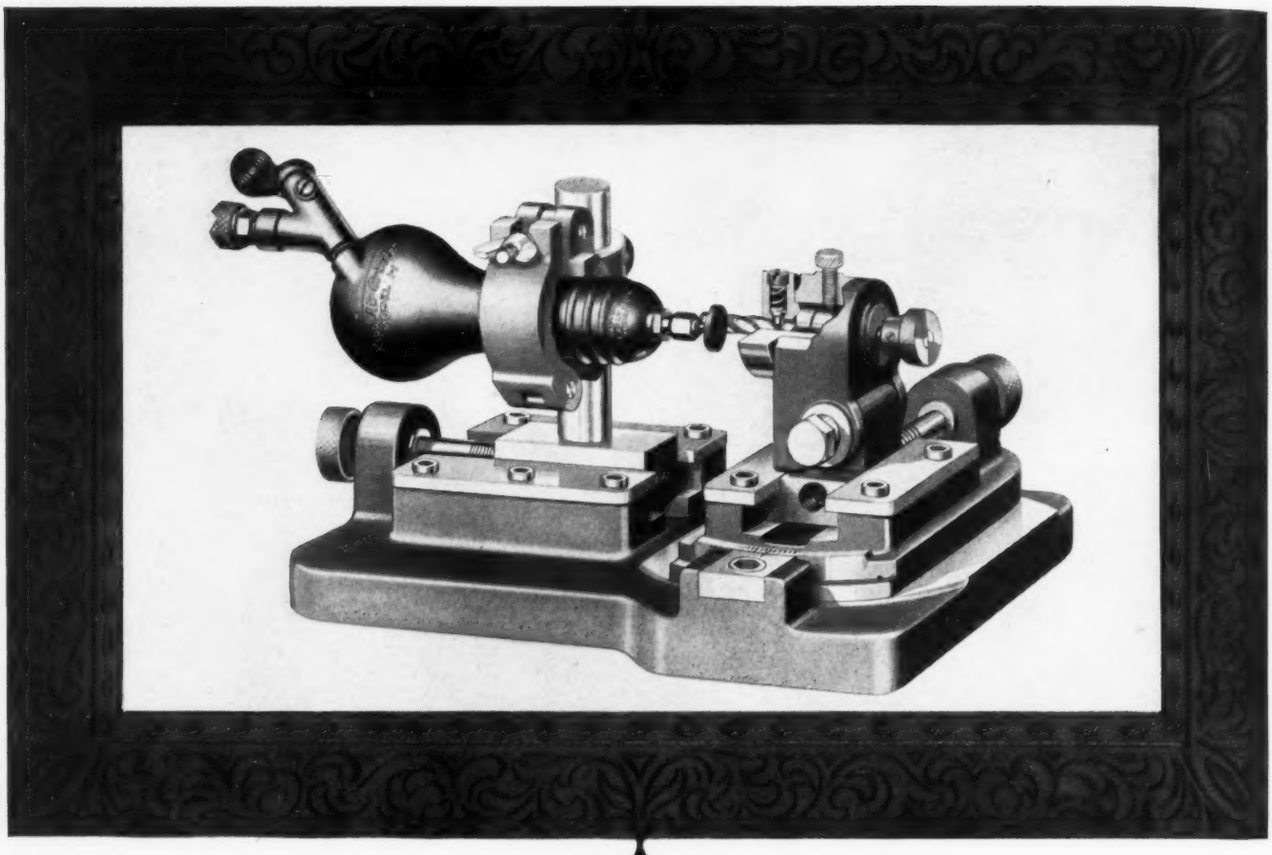
TORRINGTON NEEDLE BEARINGS

KEYED TO TODAY'S NEEDS

AND TOMORROW'S TRENDS



WAR-TIME SUGGESTION

from Madison-Kipp

If you have to make some of your own special drills, reamers, counterbores, etc., etc., to get them in time for your urgent needs, you may be interested in the Kipp Air Grinder Fixture illustrated above. We made one for ourselves and it works very well. We do not manufacture them for sale but we will gladly send you our toolroom sketch sheets to be used as a guide for your own mechanics to follow, for a nominal charge of fifty cents to cover blue printing and mailing.

You can, of course, vary this fixture design to suit your own requirements, but the basic idea is very good and if you make it complete, as shown, you will find that it is extremely valuable.

The Kipp Air Grinder, as well as the Kipp Air Grinder fixture, was developed by practicing toolmakers so both *are* practical.

MADISON-KIPP CORPORATION,
203 Waubesa Street, Madison,
Wisconsin, U. S. A.

The New Model **H** *air*

KIPP GRINDER

How To Get The Most Out Of STARRETT

HACKSAW BLADES

DO

Select the right blade for the stock. Be sure the length, width, thickness and number of teeth are correct.

Insert the blade with the teeth pointing in the direction of the cut.

Use recommended speed and feed for metal being cut. Increase pressure at intervals to compensate for blade wear.

Clamp the work securely to prevent shifting.

Use a cutting compound except for iron castings.

DON'T

Don't try to get good work out of a worn out or poorly adjusted machine.

Don't use a heavy blade in a light machine or for small work.

Don't over-strain the blade or run it with too little tension.

Don't let mounting pins become worn or out-of-round.

Don't start a cut with too much pressure.

Don't use a new blade to finish a cut started by an old one.

Don't waste time and power cutting with a worn out blade.

Starrett S-M Molybdenum Special Alloy High Speed Steel Hacksaw Blades are recommended for the tough, hard-to-cut metals and alloys, and Starrett Tungsten Alloy Blades remain the standard for cutting performance and economy on run-of-mill work. Order a trial supply from your mill supply dealer today.

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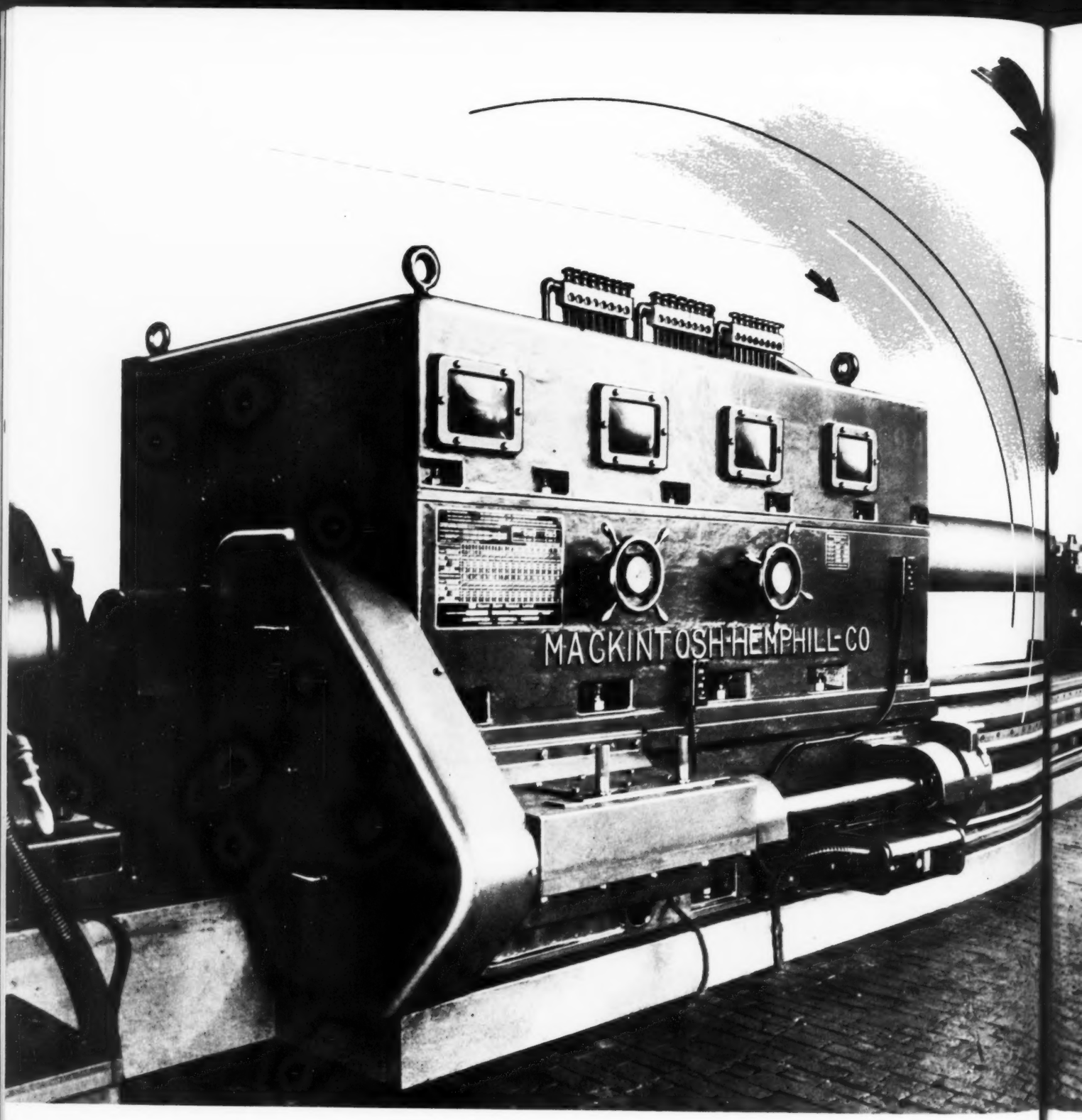
MACKINTOSH-HEMPHILL-CO

Mackintosh Heavy-Duty Engine Lathes

remove metal

2 to 3 times faster

than ordinary heavy-duty tools

Mackintosh-Hemphill Heavy-Duty Engine Lathes have three fundamental improvements over previous designs. They are: 1. A new head stock design. 2. An improved carriage with a new method of power feeds. 3. A new arrangement of the bed and ways. Each of these was accomplished without unnecessary devices and auxiliary parts. These lathes are thoroughly proved in every respect and many are now operating in plants all over the country.

The economic advantage of the Mackintosh Heavy-Duty Engine Lathe is five fold:

1. Heavier cuts with greater accuracy in turning and tapering. Roughing cuts up to ¼ inches by 2 inches deep are readily obtainable on many classes of work.
2. Heavy duty roughing, finishing, and tapering, simultaneously, on the same machine with greater efficiency.
3. Cutting of any length of taper by one set-up which reduces the over-all time from one-half to one-quarter of that necessary with standard taper attachments.
4. Accuracy of the taper is not dependent on the skill of the operator in making a set-up.
5. Lower maintenance and operating cost.

Mackintosh Heavy-Duty Engine Lathes are produced in the following sizes:

SIZE OF FACE PLATE	CENTER TO CENTER
42 inches	15 to 50 feet
48 inches	15 to 60 feet
60 inches	15 to 85 feet
72 inches	15 to 85 feet

Write for complete engineering and operating details

Since 1803—Pioneers, Engineers and Builders

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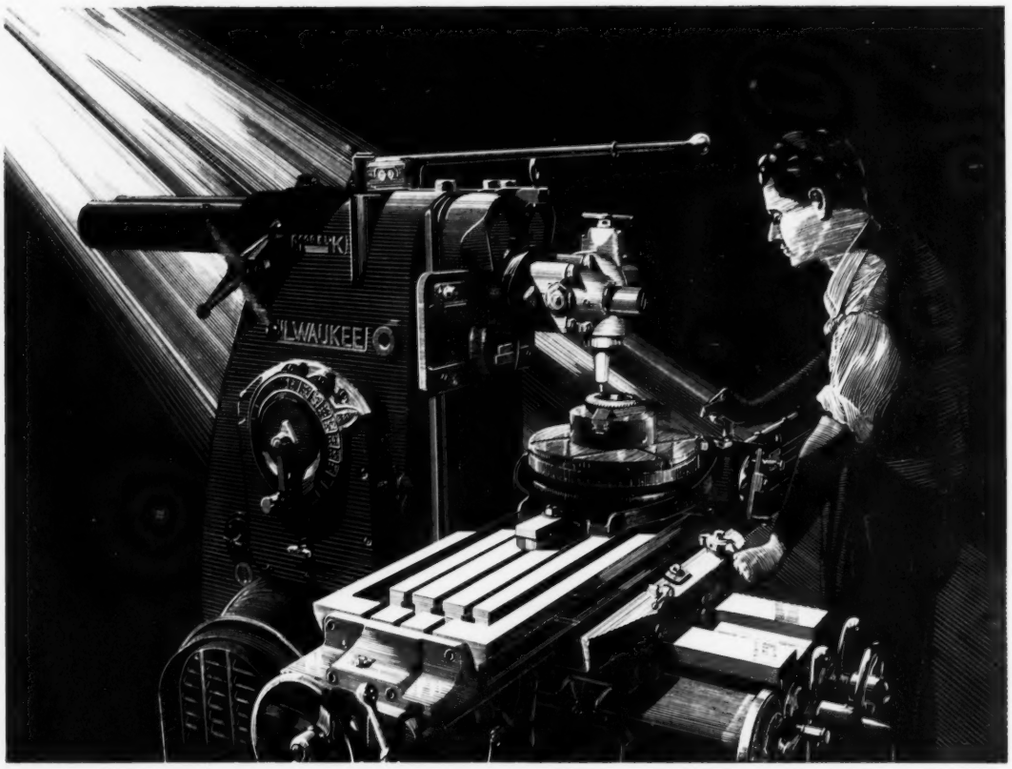
"Techni" Process Rolls . . . Rolling Machinery . . . Shape Straighteners . . . Strip Coilers . . . Shears . . . Levellers Pinions . . . Special Equipment . . . Iron-Steel Castings . . . And the New Abramson Straighteners for Solid rounds, pipe, tubing—for sizing and polishing.



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Here's a sixty-four dollar question for production men — what attachment quickly converts plain or universal horizontal Milwaukee Milling Machines enabling them to do more than five out-of-the-ordinary milling operations?

It's the Milwaukee Standard High-Speed Adjustable Universal Milling Attachment and here are the jobs it will handle:

— end mill a scroll (as shown above and using a low lead attachment and rotary table).

— for intricate milling on dies, templates, patterns.

— for milling dovetails, T-slots, other hard-to-get-at operations.

— for circular milling of various kinds, working with a rotary table.

— for spiral milling at high speed, working with a dividing head and lead attachment.

Buy Victory with at least 10% in War Bonds!

'43 FOR VICTORY

When You Can't Get A New Machine . . . conversion of existing equipment to special milling operations is often the answer. The Emergency Production Service Department of Kearney & Trecker is organized to aid you on quick conversion or tougher milling problems. Write or wire — you'll get action pronto.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN

Milwaukee MACHINE TOOLS

Gulf Cutting Oils

UP to 100% greater production, up to 1000% longer tool life, better finishes on the work —these are the results obtained with Gulf Cutting Oils in plant after plant.

Engineered for the production requirements of *today*, Gulf Cutting Oils combine the best possible lubrication and effective cooling in the cutting and tool-chip contact areas. In practically every case, machine tool performance and work finish are greatly improved with these specially prepared cutting oils on the job. Improved chip quality and shape reflect improved cutting to experienced operators.

Let a Gulf Lubrication Service Engineer demonstrate — in *your* plant — how Gulf Cutting Oils can help you get improved machining practice and increased production.

For additional information on Gulf Cutting Oils, send the coupon below.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company M
3800 Gulf Building, Pittsburgh, Pa.

Please send me, without obligation, a copy of the new booklet, "Gulf Cutting Oils," which includes a 24-page Machining Guide.

Name .....

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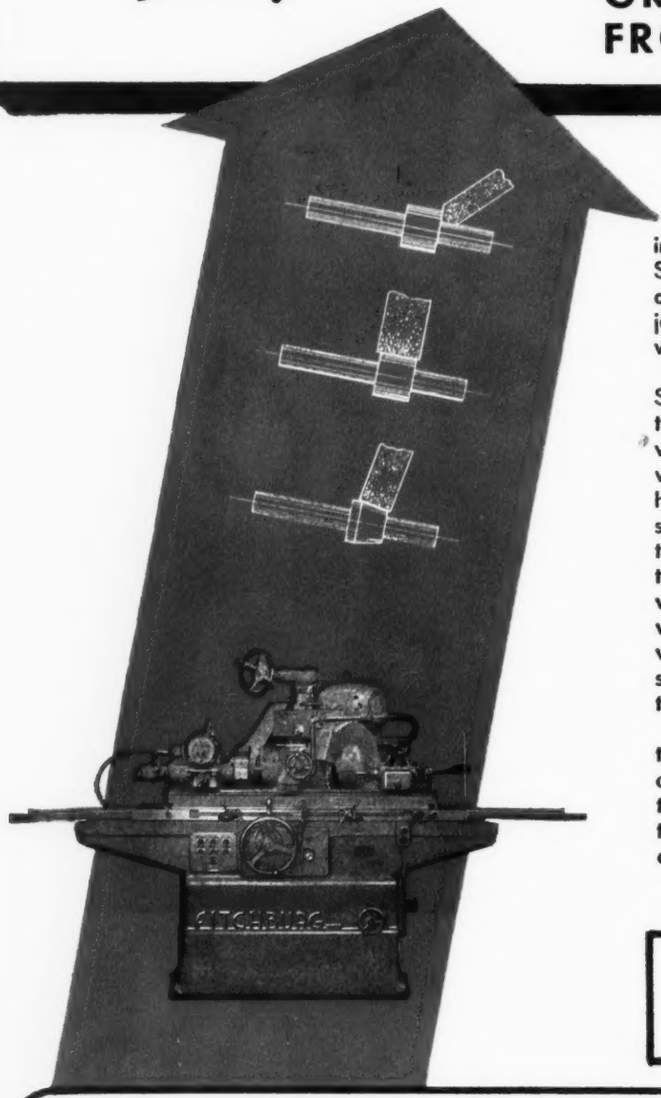
New FITCHBURG ADJUSTABLE "TYPE C"

Angular Head Grinder

FOR PLAIN CYLINDRICAL GRINDING . . . . . FROM *0 degrees to 45 degrees*



The Fitchburg Adjustable "Type C" Angular Head Grinding Machine is another single application of the Fitchburg Standard Bowgage Wheelhead Unit. The "Type C" is designed to handle a wide range, and a number of types of jobs. In finding ways to cut your grinding time and costs it will pay to consider what this machine can do.

This newest of Fitchburg plain cylindrical grinders has a Standard Wheelhead Unit mounted so that it may be located to grind from 0 degrees up to a 45-degree angle. Previously angular head grinding machines have been equipped with fixed heads for single purpose grinding. The Bowgage head on the Fitchburg "Type C" is adjustable and can be swivelled to various positions for standard plain grinding, thus providing greater grinding utility. The head goes through a completely automatic cycle — rapid traverse to work, correct feed, grinding dwell and rapid return. The workhead is adjustable for various lengths of work and the work spindle can be equipped for single or variable work speeds. The trueing device is hand operated and mounted on the work table.

The Fitchburg "Type C" grinder is designed to meet war time production speed and maintain highest efficiency. Ease of operation is assured by centralized controls. In every detail it meets all the requirements of plain cylindrical and taper grinding — in large or small lots of work, with assured accuracy and fine finish, at low cost.

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FITCHBURG GRINDING MACHINE CORP.

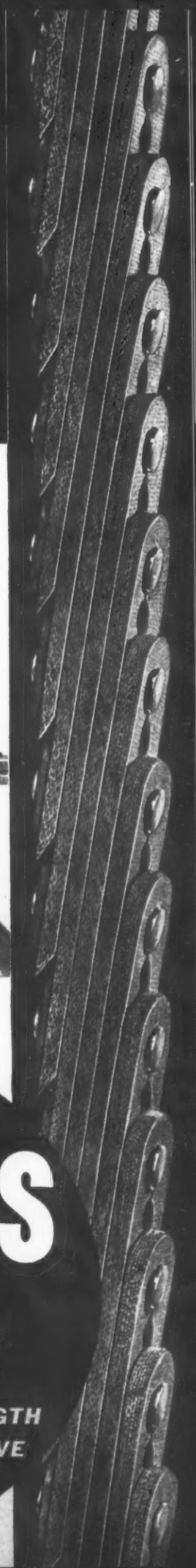
FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of **— Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.**

The Policy That Insures

PRODUCTION:

"Standardize on VEELOS"



VEELOS keeps machines running at full speed and productivity because link construction provides quick, easy adjustment . . . reduces machine downtime . . . ends slippage. With Veelos in rolls, strands can be replaced quickly and easily, keeping all belts on the drive and maintaining equal tension. You insure maximum production when you standardize on Veelos for all V-belt drives.

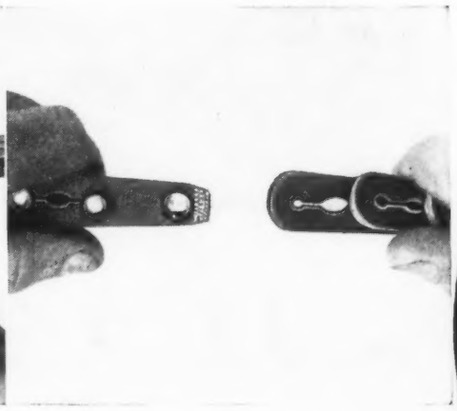
HOW TO
NCOUPLE
LL SIZES
F VEELOS
V-BELT
Link Construction)

1. *Hold belt with left hand. Insert screw-driver under top segment as far as slot.*

2. *Hold stock firmly with thumb over screw-driver blade and press handle down.*

3. *Slip tip of blade over rivet head and lift handle enough to pry segment loose.*

4. *Repeat on 2nd rivet for "B"; 3rd rivet for "C"; 4th rivet for "D"; 5th rivet for "E" section belting. Underneath segments removed in same manner until last rivet slips out easily.*



5. *THE BELT IS APART.*

VEELOS

THE LINK

V-BELT

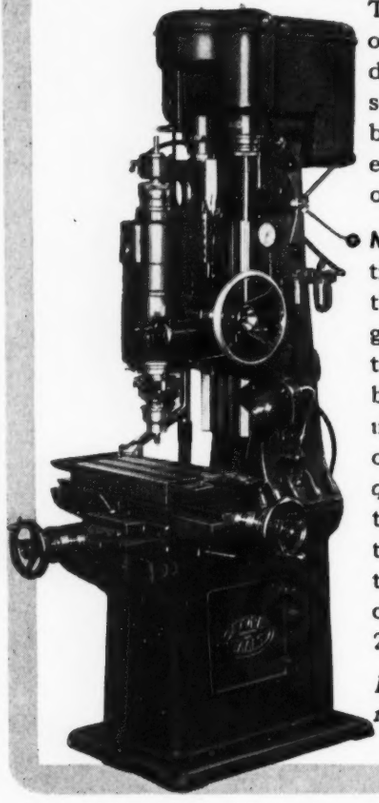
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

ANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

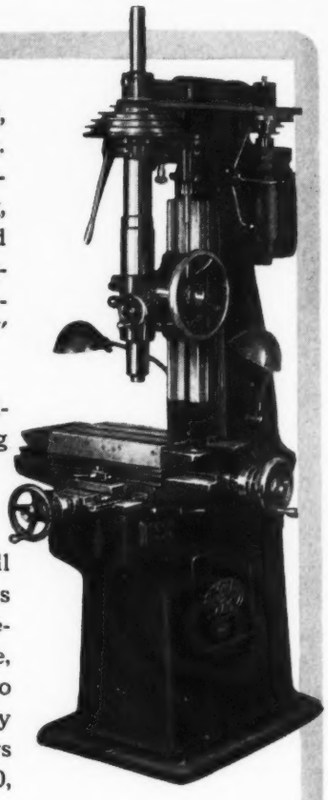
Teamwork SCORES IN THE TOOLROOM, TOO

Official Photo
U. S. Army
Signal Corps

The mechanical time fuse which fits in the nose of anti-aircraft shells is a complicated piece of clockwork requiring multiple-station dies of extreme precision. These dies were designed and produced by Moore tool-and-die specialists, aided by the speed and efficiency of the Moore Jig Borer and the Moore Jig Grinder, "Partners in Production."



MOORE JIG BORER bores the holes in these die sections before hardening, thus holding the location as close as possible to eliminate excessive grinding. This Partner features a fundamental process of co-ordinate location, which permits accurate spotting, drilling, reaming and boring in one uninterrupted sequence. Easy to operate, it solves layout and jig-boring problems, produces more holes to closer tolerances in less time. It is sensitive for holes of 1/32" or smaller, and rigid for heavy cuts.



MOORE JIG GRINDER finishes the pieces of the multiple-station dies after hardening. Instead of grinding the holes in each section of the die at a time and going through all of the laborious steps of centralizing, locating, indicating, grinding, re-assembling and checking, the Moore Jig Grinder does it all in one setting, with the die completely assembled in its own die-set and located on its own dowels—*in one-quarter the time!* Besides this saving in toolroom time, the Jig Grinder increases the life of a die from two to twenty times that of an unground die. It has a capacity to grind holes from .030" to 4", accuracy of screws of .00005" per inch, and grinding speeds of 15,000, 25,000 and 45,000 RPM.

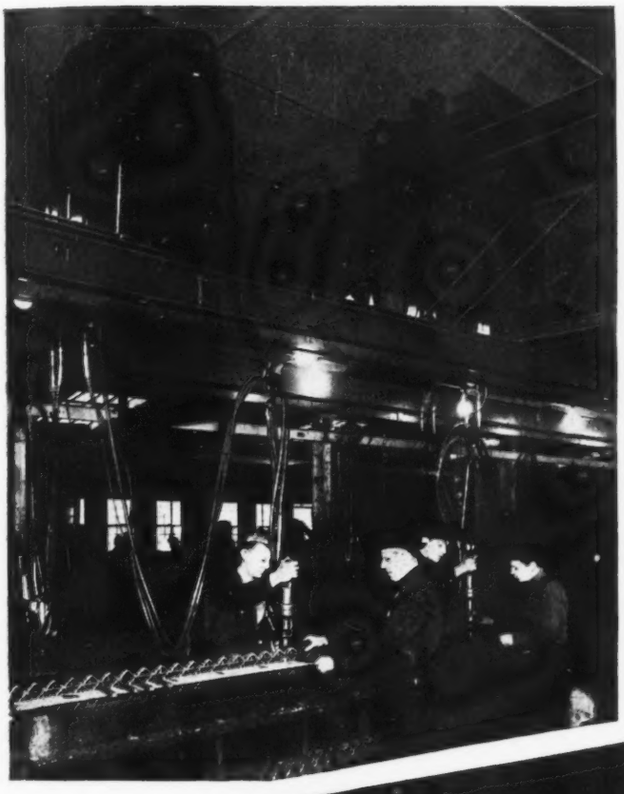
Discover how these two machines and their time-saving accessories can modernize your toolroom operations. Write today for descriptive catalogs.

Manufactured by MOORE SPECIAL TOOL CO., INC · Bridgeport, Conn.

MOORE TOOLS

EXCLUSIVE DISTRIBUTORS: MARBURG BROTHERS, INC · 90 WEST STREET, NEW YORK, N.Y.

"Hy-Power" hydraulic riveters at the plant of Irving Subway Grating Co., Inc. The hydraulic pressure generator units are installed on the balcony, simplifying piping.



Built to take a beating and stand up to it...

HANNIFIN "Hy-Power" hydraulic riveters are providing faster, better riveting on a great variety of essential production, including the "Subway" grating shown here. Commenting on the ability of "Hy-Power" riveters to stand up under continuous service, this user says, "... **this equipment has been in service twenty-four hours per day, seven days a week, for over two years, with little or no maintenance costs.**"

The exclusive "Hy-Power" hydraulic operation combines fast, easy handling and a tighter, more uniform rivet application. The hydraulic squeeze riveting action not only forms a perfect head, but spreads the rivet body to fill the hole better and tighter than is done by other methods. The automatic operating cycle is push-button controlled, with speeds of standard units ranging from 1½ to 3 seconds per cycle, with 3 to 4 inch stroke.

Hannifin "Hy-Power" equipment meets today's needs for fast production, uniform quality of work, and continuous duty. In addition to production riveting, "Hy-Power" equipment is being used for press-fit assembly, punching, and other work involving the application of pressure. Write for "Hy-Power" bulletin No. 53, or consult Hannifin engineers for specific recommendations.

★

HANNIFIN
Manufacturing Company
621-631 South Kolmar Ave., Chicago, Ill.

★ *"hy-power"* ★

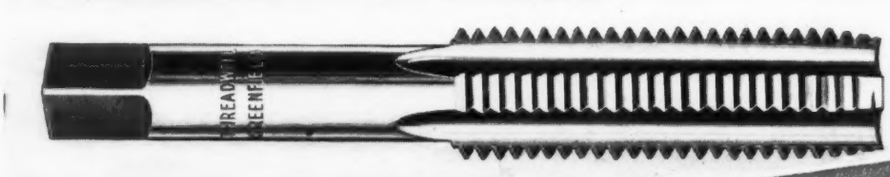
Your tap has outlasted any others which we have used

EXCERPT FROM CUSTOMER'S LETTER

A spinning finger of polished steel . . . cutting delicate chip curls . . . a thread is formed, accurate and true to the thousandth of an inch . . . dozens of threads, hundreds of threads, thousands of threads . . . a Threadwell Ground Thread Tap is setting new records for "holes per tap" *somewhere on the production front.*

In our files are dozens of recent letters of thanks that fall into two groups . . . letters from *purchasing* men in appreciation of the *personal attention* their orders for taps have received from Threadwell and its distributors, and letters from *production* men telling us how well our taps have performed in high speed tapping machines.

If your "bottle-neck" is threading tools, call on your Threadwell distributor.



Threadwell

"TAPS OF DISTINCTION"

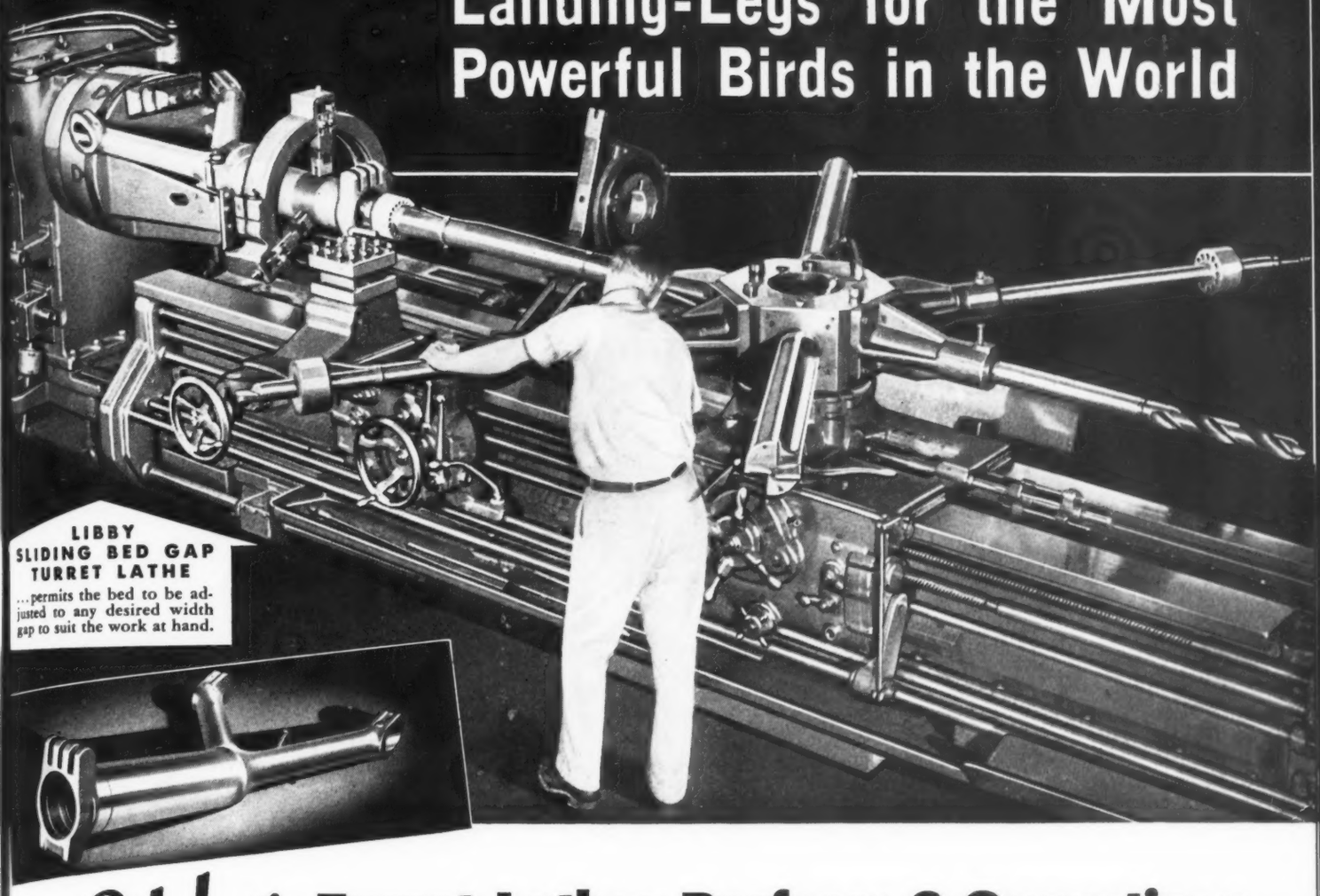
★

Sales Agents

CANADA: BRIDGE MACHINERY CO., MONTREAL
ENGLAND: SKYLUX LTD., LONDON

THREADWELL TAP AND DIE CO., GREENFIELD, MASS., U.S.A., FOUNDED 1902

Landing-Legs for the Most Powerful Birds in the World



LIBBY SLIDING BED GAP TURRET LATHE
...permits the bed to be adjusted to any desired width gap to suit the work at hand.

Libby Turret Lathes Perform 9 Operations on Airplane Landing Struts

Drilling a 6¼" diameter hole, 34½" deep, from solid forged steel is the first operation performed on this Libby Heavy Duty Sliding Bed Gap Turret Lathe. Subsequent operations include additional drilling, boring, forming, reaming and threading operations.

Due to the design of the landing leg, it is necessary to use a special cradle-type fixture mounted to the face of the chuck. Further provision is made for handling this oddly shaped part through the bed gap design of this Libby Heavy Duty 4H Turret Lathe. The Sliding Bed Gap Turret Lathe is a Libby innovation. This particular machine is provided with a gap to swing 84" diameter and the width of the gap may be adjusted from 0" to 44". Fixed bed gap machines can also be furnished.

This is another example of International service in unusual turret lathe work. Perhaps our engineers can help you on similar work. They are available for consultation without obligation.

The Job in Brief

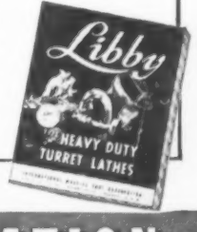
Part—Airplane Main Leg Landing Strut.
Material—3140 Forged Steel.
Holding Method—Special Fixture Mounted on Chuck Face.

OPERATIONS:

1st—*Drill 6¼" Dia. Hole*...34½" deep from solid.
2nd—Drill 2⅞" dia., 1" deep in bottom of 6¼" hole.
3rd—Form 5 13/16" dia., 3½" deep, blending ⅜" radius to ¾" radius.
4th—Bore 6.875" hole with piloted bar.
5th—Drill and ream ⅞" hole in bottom of 6.875" hole... 42" from front end of strut. Tolerance on this operation .001".
6th—Face with cross slide.

The piece is then heat treated and additional operations performed on Libby Heavy Duty Turret Lathe.

FREE booklet contains additional information concerning other valuable features of the Libby Heavy Duty Turret Lathes...write for your copy today. Write to the Libby Division, 1128 W. 21st Street, Indianapolis, Indiana.



INTERNATIONAL MACHINE TOOL CORPORATION
LIBBY DIVISION, INDIANAPOLIS, INDIANA · FOSTER DIVISION, ELKHART, INDIANA
MAIN OFFICE AT ELKHART, INDIANA
FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS
SUPERFINISHING MACHINES · BARKER CHUCKS · UNIVERSAL RAM TYPE TURRET LATHES

PRODUCTION RULES FOR EFFICIENCY

For More and Better Grinding

IN FOUNDRIES AND STEEL MILLS

WHEEL SPEEDS:

1—For Resinoid Bonded Wheels—constant wheel speed of 9,500 surface feet per minute will maintain most economical wheel cost.

2—For Vitrified Bonded Wheels—constant wheel speed of 6,500 surface feet per minute will maintain most economical wheel cost.

3—Constant surface speed should be maintained as the Grinding Wheel decreases in diameter through use. The speed of the spindle should be increased correspondingly as the wheel diameter decreases. This can be accomplished by means of a variable speed countershaft or cone pulley on the grinder or by transferring from a larger grinder to a smaller one with higher spindle speed.

GRINDING PRESSURE:

1—Increased economy may be obtained by increasing the pressure (or direct load) at the point of grinding contact to the extent where lowest total grinding cost is obtained. The best pressure to use can be determined by test.

2—Too much grinding pressure will break down the wheel and increase grinding cost per pound of metal removed. Select the proper grade of wheel so that too much pressure need not be applied to obtain maximum cutting rate in relation to wheel wear.

GRINDING MACHINE: 1—The grinding machine, whether floor stand or swing frame, should be as free from vibration as possible. Vibration tends to break down the wheel and causes excessive wheel wear. Spindles should be rigid and run true and free, bearings should be in excellent condition and wheel mounts true and up to size.

GRINDING OPERATOR:

1—The workman's knowledge of the tool he is using, and its limitations, is the most important factor in obtaining most efficient use. This is particularly true of Grinding Wheels.

2—Use a Grinding Wheel with care; do not "abuse" it by "edging" it, or by bumping the work, or by applying too much pressure.

3—Proper use of the wheel will produce the same number of pieces per hour and will give longer wheel life.

GRINDING WHEEL SELECTION:

1—Use the grain and grade combination that will give best results. In general, use coarse grain sizes (12, 14, 16, 20, etc.) and hard grades (P, Q, R, S, etc.).

2—On high speed grinders use Resinoid Bonded Wheels at 9,500 surface feet per minute. On low speed grinders use Vitrified Bonded Wheels at 6,500 surface feet per minute.

3—For grinding steel castings, billets, forgings and annealed malleables use ***Borolon*** (Aluminum Oxide) WHEELS.

4—For grinding gray iron castings, unannealed malleables, brass, bronze and aluminum use ***Electrolon*** (Silicon Carbide) WHEELS.

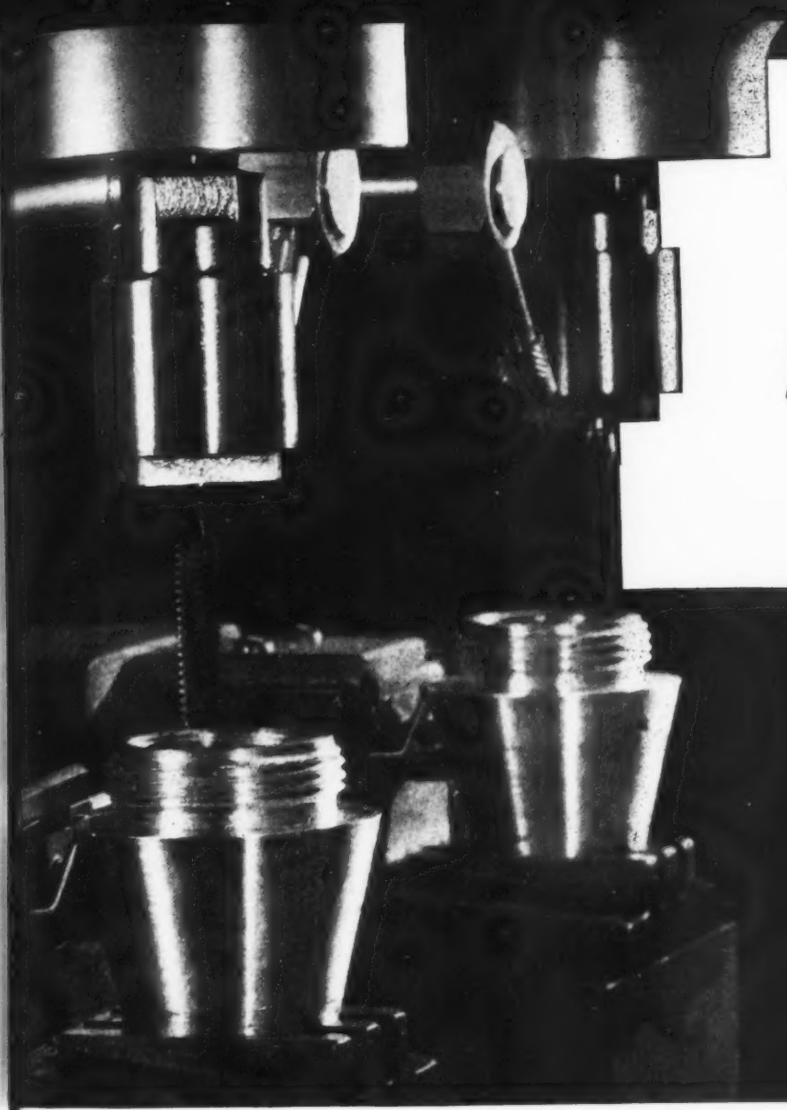
Close attention to the above details will mean more production from your grinding operations—and more GUNS, TANKS, TRUCKS, SHIPS and PLANES TO "SPEED VICTORY"!

ABRASIVE COMPANY

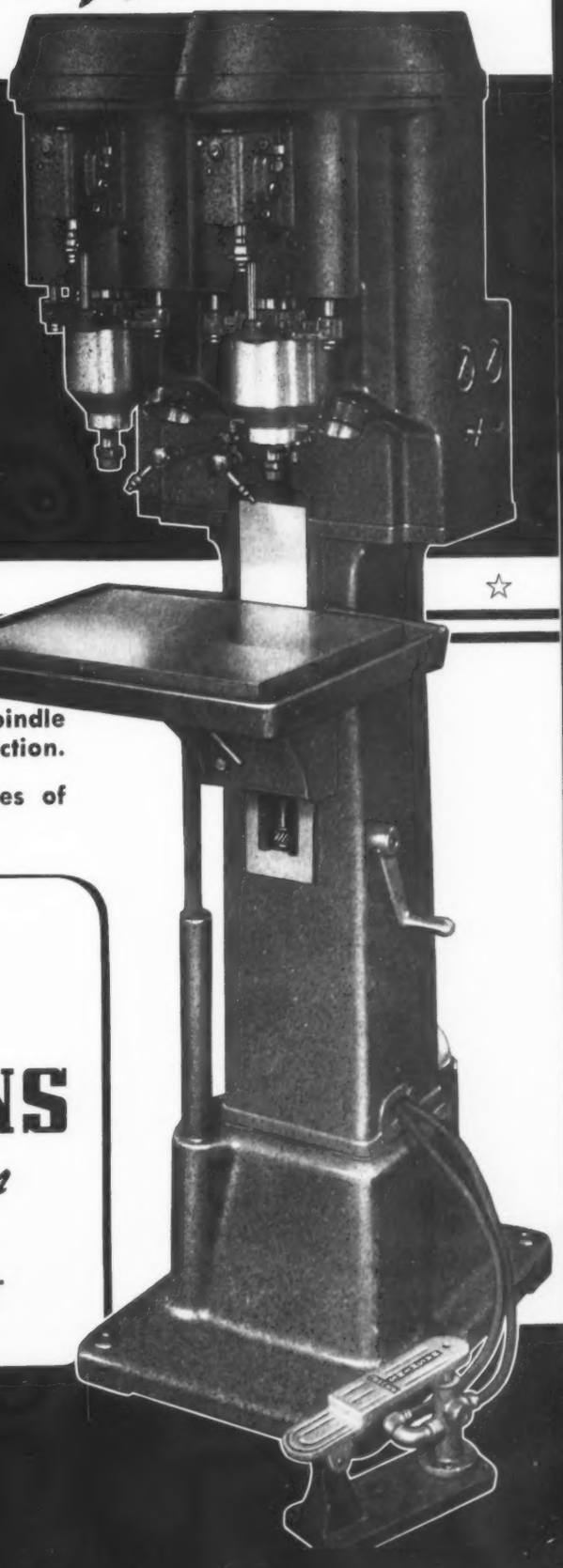
DIVISION OF SIMONDS SAW AND STEEL CO.

TACONY & FRALEY STS., PHILADELPHIA, PA. • CHICAGO BRANCH: 127 SOUTH GREEN ST.

DISTRIBUTORS IN ALL PRINCIPAL CITIES



Tips for faster, more accurate Tapping!



FOR TAPPING TWO HOLES in one piece, a Haskins Two Spindle Tapper—with *Piece Part Control*—substantially speeds up production.

In the operation above (aluminum fuse bodies), two holes of different sizes are tapped by one operator, on one machine.

Parts are placed in the fixture, pressed against pins operating micro switches and—*air does the rest.* With both hands free, the operator can handle parts faster—much faster. Everything else is automatic.

The accuracy of the work is constant—uniformly controlled by air! That's why there is no tolerance problem on Haskins Tappers. Why each part is tapped *exactly* like each other—to Class 4 fit when necessary.

Tapping the Haskins way is faster, definitely more accurate, definitely less costly. R. G. Haskins Company, 618 S. California Avenue, Chicago.

AIR Control

HASKINS

Precision

TAPPING EQUIPMENT

HASKINS

FOR ADDITIONAL TAPPING TIPS send for our latest literature, devoted largely to war work. Gives many money-saving, money-making ideas. Free on request.

FEDERAL
1308
MADE IN U.S.A.
FEDERAL
BEARINGS
TRADE MARK
QUALITY
FOR THE DURATION, WE ARE UNABLE TO SUPPLY MANY TYPES OF BEARINGS FORMERLY MANUFACTURED
THE FEDERAL BEARINGS CO., INC.
Makers of Fine Ball Bearings
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REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower • Cleveland: 402 Swetland Building
Chicago: 902 S. Wabash Ave. • Los Angeles: 5410 Wilshire Blvd.

MORE *man* POWER TO YOU!

Your new men will learn quickly on Cones.

Automatics machine more pieces, in less time, in less space, with less waste. They save man hours.

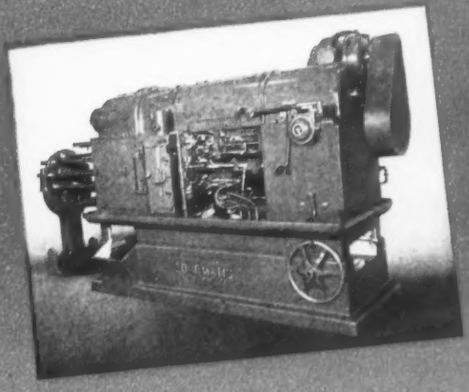
The Conomatic single overhead camshaft makes more room for tooling, cutting oil and chips. Their feed and speed ranges are adequate for any job within their capacities.

An operator should know his machine, and Conomatics are designed for ready understanding.

Experienced operators usually understand any automatic. Start your new men with Cones.

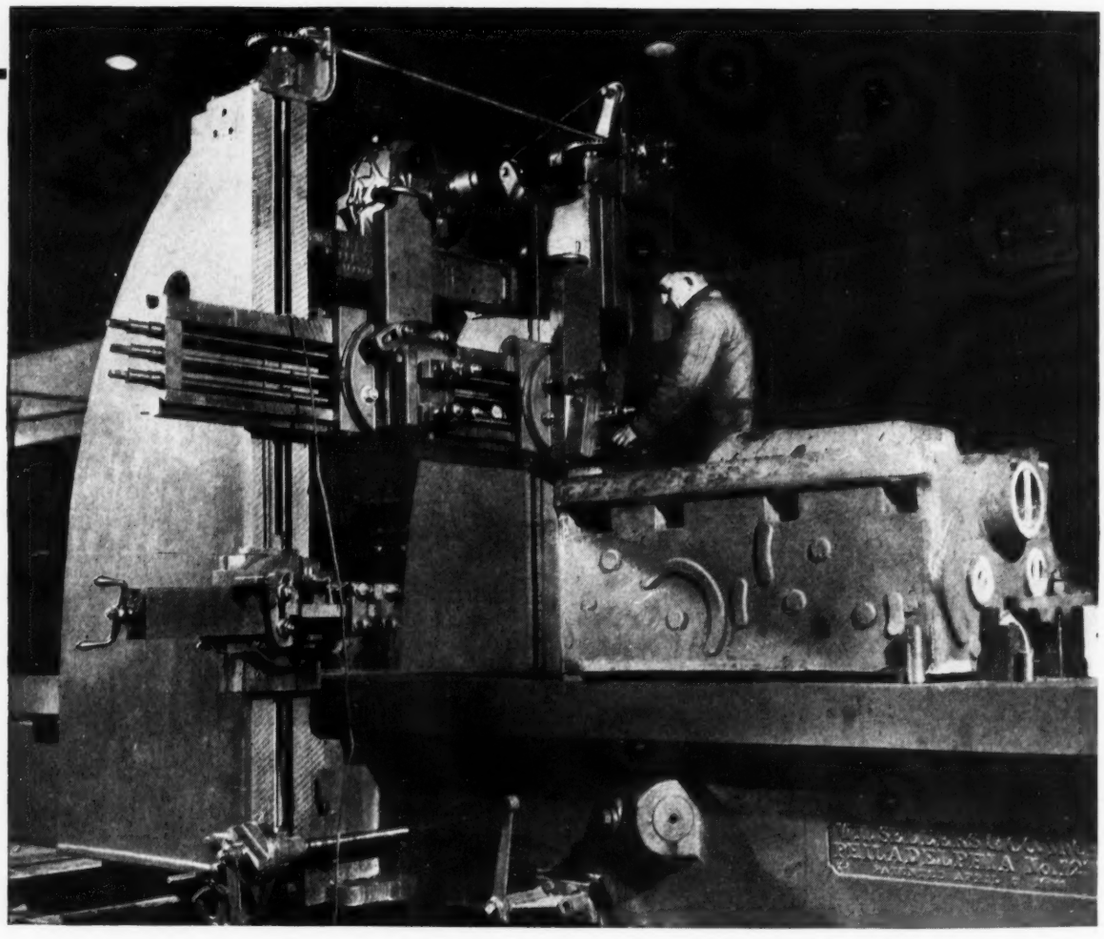
CONE Automatic Machine Company, Inc.

Windsor, Vermont, U.S.A.



WEAPON No. 1

IN A WAR OF METAL*



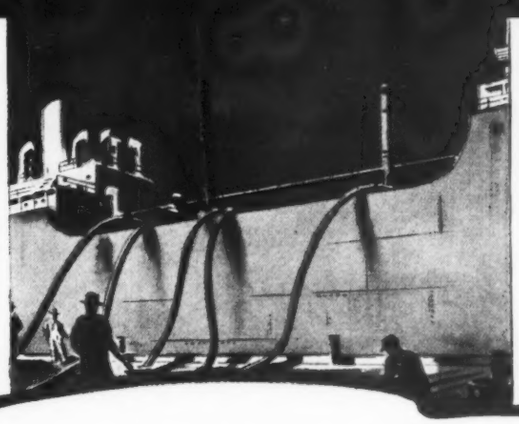
* *Keep your machine tools in fighting trim by* ENGINEERED REBUILDING

Every piece of ordnance from the blueprint to the battlefield takes shape through machine tools. Not enough metal is available to build all of the machine tools required. *Therefore, industry must make the most of those it has.* This can be successfully achieved by keeping machine tools in fighting trim, by *Engineered Rebuilding* when they need repair. • Simmons has solved machine tool rebuilding and maintenance problems for leading armament plants. Learn how we can help you. Send today for a copy of "The Simmons Way." Simmons Machine Tool Corporation, 1600 N. Broadway, Albany, N. Y.

ARMY (E) NAVY

SIMMONS *Engineered* MACHINE TOOL REBUILDING

…hetic rubber facilitates well …lling. MANHATTAN oil-proof …ary Hose and Molded Products, …g used in all important fields. …Tanker time is saved by use of …hetic rubber in Paranite G.O.P. …l Hose.



Long before Singapore

Synthetic rubber's most vital use is in airplanes—for fuel and control hose, in molded diaphragms, and in motor packings, of which MANHATTAN is a principal supplier.

Air-operated tools deliver steadier service with …nger hose life when hose is lined with G.O.P. …nthetic rubber.

Paint spraying speeds delivery of combat equipment. Only synthetic rubber resists action of paint and varnish.

Trucks, buses, tanks and jeeps, all have scores of oil-proof synthetic rubber parts to keep 'em rolling.

MANHATTAN was a Veteran in the use of *Synthetic Rubbers*

For years before the fall of Singapore, the use of several varieties of synthetic rubber was well-established in the manufacture of the products illustrated. These synthetic rubbers had special properties not possessed by natural rubber, such as: resistance to oils, sunlight and heat.

Because natural crude rubber was satisfactory, plentiful, and the supply seemed safe (Singapore was considered impregnable), no major (and costly) research and development programs to perfect and supply synthetic rubbers as a substitute had been initiated.

Under today's rising and tremendous program, widely publicized, vast quantities of *all-service* synthetic rubbers will be produced in months to come to replace natural crude rubber. Differences in physical characteristics, not easily recognizable to the layman, but of profound significance to the rubber technician, present highly diversified problems in the art of compounding and using these new *all-service* synthetic rubbers.

The accumulated experience of all manufacturers in the use of special-type synthetic rubbers is proving very valuable in building up the art of substituting these new synthetic types for natural rubber. The full and free interchange of information, fostered by Washington and the Industry, is speeding the results at a pace which should confirm confidence in the ability and talent of the Industry to turn out good, usable, often better, products for War and essential civilian needs.

MANHATTAN expects to further its already substantial contribution to this tremendous program of development through extensive facilities, engineering talent and a long and comprehensive experience in the use of special-type synthetic rubbers in its Paranite—G.O.P. products.

Pioneering in the developments and applications of synthetic rubbers was a natural sequence to the continuous program of research which has been inherent with MANHATTAN throughout the 50 years of its progress. To the long series of contributions to Industry, more will be added.

THROW YOUR SCRAP INTO THE SCRAP!

KEEP AHEAD WITH MANHATTAN

THE MANHATTAN RUBBER MANUFACTURING DIVISION

of RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES PASSAIC, NEW JERSEY

"Commercial" ANNULAR BALL BEARINGS

EFFICIENCY • ACCURACY • ENDURANCE

• USED IN HUNDREDS OF DIFFERENT PRODUCTS •

WE supply ball bearings for every industrial purpose—standard types, or bearings designed for unusual installations.

SCHATZ **"Commercial"** Bearings are made from high-grade steels, carefully heat-treated. They have the capacity, strength and endurance essential to long bearing life and efficient service.

On this page, we illustrate **"Commercial"** bearings of unusual design—a few of hundreds of different types manufactured by us. These illustrations convey some idea of our skill and ability in solving intricate ball bearing problems.

•

FOR THE DURATION, WE ARE UNABLE TO SUPPLY MANY TYPES OF BEARINGS FORMERLY MANUFACTURED

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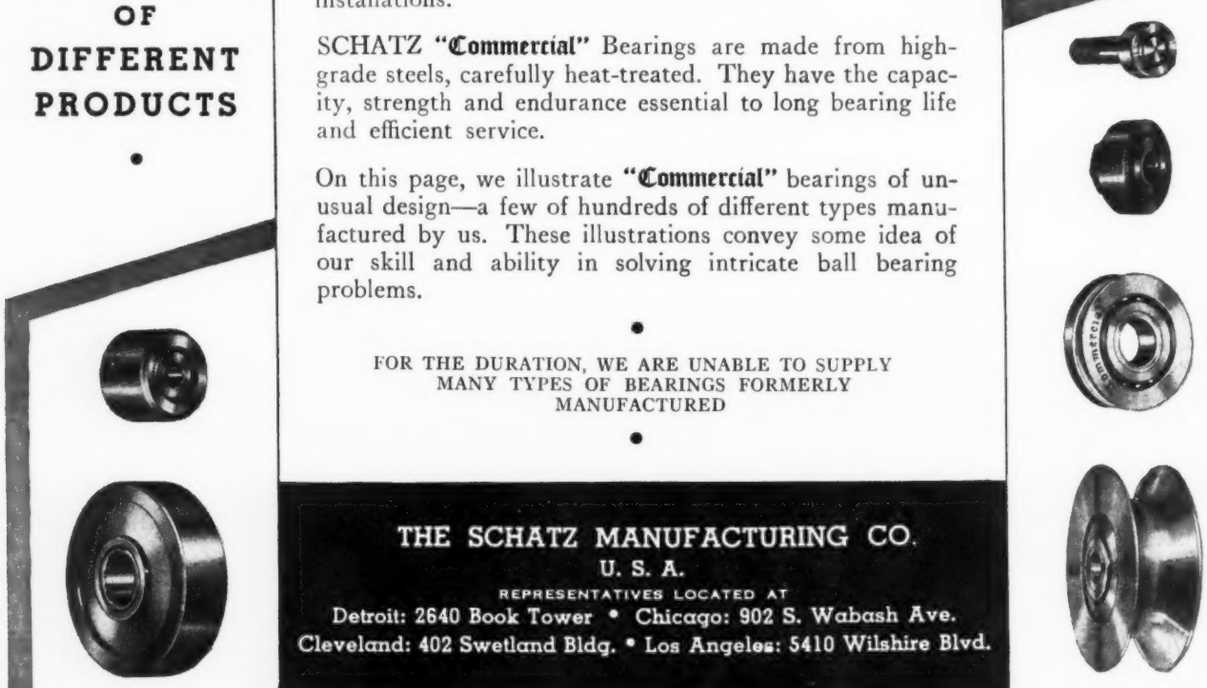

THE SCHATZ MANUFACTURING CO.
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REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower • Chicago: 902 S. Wabash Ave.
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Women's hands take over

—to release men's hands for fighting!

IN scores of war plants, women have replaced men as turret lathe operators. Results have been surprisingly good. Of course, women with a few weeks' training can't be expected to fill the shoes of expert, experienced machinists, but for the steady, repetitive turning operations needed for much of today's war work, women operators are a logical answer to manpower shortages.

Close supervision is necessary and help in chucking and handling heavy parts must be given but because of the extreme accuracy and rugged durability built into modern Warner & Swaseys, maintaining close tolerances is not a major difficulty.

Plants now using women turret lathe operators (and there are many of them) find after a few weeks' training, women turret lathe operators are fast and dependable, with scrap losses held remarkably low.

The convenient controls and speed regulators on Warner & Swaseys minimize manual effort and lessen fatigue.

Thousands of women have been working on Warner & Swaseys in England and Russia. American women can be relied upon to do an equally good job.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

Foreman checks hardening temperature by glance at the furnace's Micromax Controller.

MAKING MACHINE GUNS With Help of Micromax Pyrometers

The control of temperatures in such heat-treating operations as homogenizing, normalizing, hardening, cyaniding, annealing, tempering, etc., is handled on scores of furnaces by Micromax Pyrometers in the vast machine-gun works of John Inglis Co. Ltd., Toronto. Tens of thousands of Colt Browning, Bren and Boys guns are leaving the Inglis plant, heat-treated by operations such as these:

Cyaniding: Pot furnaces are arranged on both sides of a central aisle. Each has a Micromax Controller right alongside, where the operator can always see it. Some of these Controllers are round-chart and others strip-chart; some use on-off control and others require full-floating, proportioning Micromax Electric Control. In any case, control is fully automatic and the Controller's micro-responsiveness and dependability help the operator to do a good job, and show the foreman its quality.

Homogenizing or grain-refining: Rough-forged gun barrels are heated in oil-fired furnaces and quenched in revolving-fixture machines, to refine the grain before being annealed, rough-turned and bored. Furnace operators are on the jump, loading the furnace and the quench machine; they never give a thought to temperature control of the furnace. But the foreman has only to set the strip-chart Micromax, and it faithfully carries out his orders. . . . Furnaces for gun-frame forgings discharge these parts directly into a quench tank. Operators thus never see the hot forgings, and so have no occasion at all for concern about furnace heat; but again the Controllers maintain temperature as "instructed" by the foreman.

This ability of a Micromax Pyrometer to carry on without attention is principally due to its automatic and semi-automatic self-servicing features. It standardizes its own measuring circuit; shows a warning if its electric power is cut off; signals far in advance of its infrequent needs for ink, chart and dry batteries. Its record is extremely easy to read.

For information about ranges, models, etc., see Catalog N-33A, Micromax Thermocouple Pyrometers, or N-33B, Micromax Rayotube Pyrometers.

depends on me!

Quick Delivery Of Metal-Saving Tubes For Thermocouples

To help save metal in the present emergency, we can now supply tubes made of "Fyrestan" ceramic ware, to replace, wherever desirable, the iron, steel and alloy tubes which protect base-metal thermocouples. Fyrestan has long been our standard for temperatures too high for alloys, and we hope that its availability for use in the alloy range will now give many firms an opportunity to reduce the number of metal tubes they require.

An additional reason for adopting Fyrestan wherever possible is that it can usually be shipped much more promptly than metal tubes.

Fyrestan is of course not as strong as metal, but it is fully as gas-tight. Its life in service is comparable with that of metal, and in some instances, in the range 1800 to 2000 F, it should outlast an alloy. In general, it can be used for all applications except the following:

1. Immersion in molten metals
2. Immersion in certain molten salt baths
3. Where unsupported length exceeds 36" vertically or 18" horizontally
4. Where work in furnace may strike tube
5. Where tube is withdrawn frequently
6. Where furnace pressure is more than 1 lb. per sq in.

When you need tubes, ask about Fyrestan. And if you have any of our "live" quotations, made before Fyrestan was available, we'll be glad to requote on the basis of Fyrestan.

Foreman and heat-treater consult Round-Chart Micromax Controller before changing charge in cyaniding pot.

Jrl Ad ENT-0600C(54)

LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Simple guard for power drills improves operation

Information supplied by an Industrial Publication

Safety in small things as well as great is an excellent policy for manufacturing plants today. Adding safety devices to small power driven hand tools has the same results as the same procedure on heavier machines. Operators can work better because their attention is undivided.

That was the idea behind a guard for power driven hand drills devised by a worker in an airplane factory. He noticed that hole spotters sometimes got pinched fingers when the drill suddenly punched through the work.

The guard is very simple. It consists of a steel sleeve set into the drill chuck surrounding the shank of the drill bit. It is easy to attach, and it could be made from scrap tubing, or bar stock cutoffs with a minimum of machining.

In operation, when the drill goes through, the guard brings up against the work, and stops forward motion of the tool. It is long enough so that the operator's fingers cannot be caught between the work and the drill body. As a result slowing down caused by the operator's natural tendency to flinch is eliminated.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE BRIQUETTES • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

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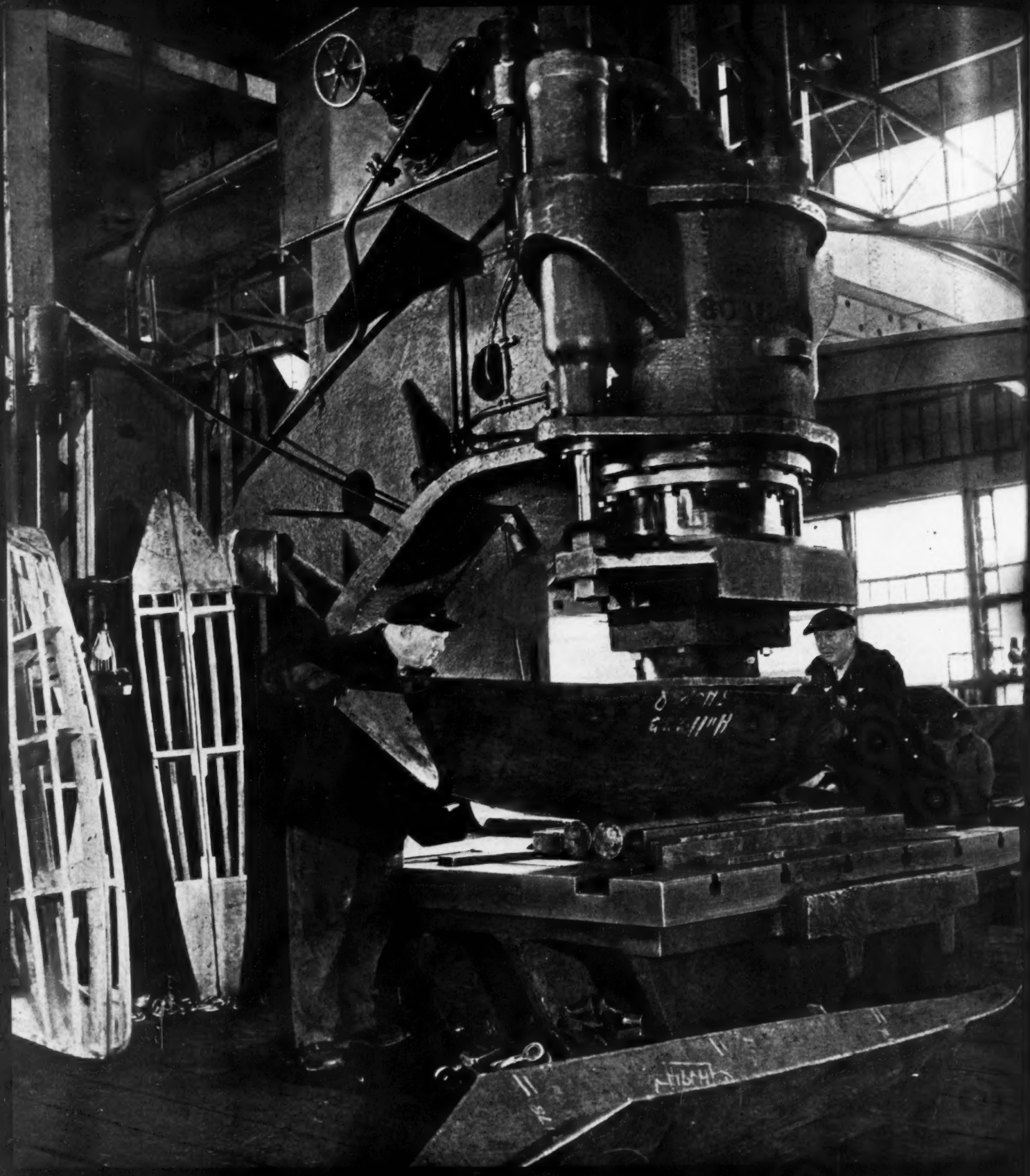
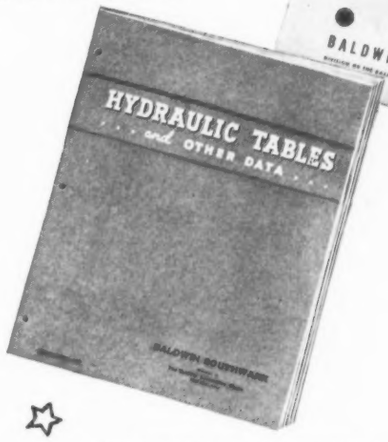


Serving America's War Industries

Bulletin A-161. Complete engineering and operating information on Southwark-Tate-Emery Testing Machines, including a description of accessories and allied equipment.

Bulletin A-162. A discussion of wartime material specifications, the interpretation of stress-strain records, and the use and care of the equipment.

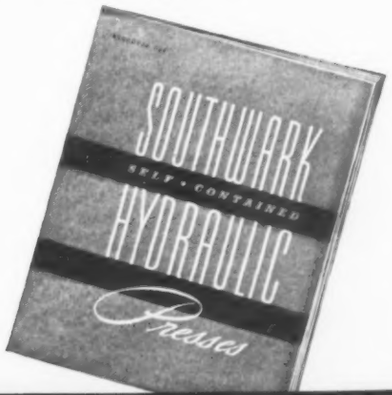
Bulletin A-150. A compilation of hydraulic tables and other useful information pertaining to those structures involving the use of hydraulic pressures for loading purposes.



Southwark is serving America's war industries through the manufacture of specially engineered equipment and highly developed heavy-duty standard machines designed for a host of diversified applications. With one hundred and six years of experience in the manufacture of industrial machinery, with unsurpassed shop facilities, Southwark is meeting war time requirements for all types of hydraulic presses, physical testing machines and instruments, rolls, planers, and special machinery—large and small.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

Bulletin A-160. A catalog containing illustrations and technical information about Southwark Hydraulic Presses for a wide variety of applications.



BLW THE BALDWIN GROUP

BALDWIN SOUTHWARK

Division THE BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*

Micromatic Anticipates Future

1. Micromatic work holding fixtures assure MAXIMUM EFFICIENCY in GENERATING FINAL SIZE, GEOMETRIC ACCURACY, SURFACE QUALITY and SURFACE FINISH.

2. Micromatic Manually Controlled Hutto-hones fulfill lower production needs with minimized equipment for any amount of stock removal desired.

3. Micromatic Automatically Controlled Microhones are specific purpose tools, for stock removal usually not exceeding .003" to .004".

4. Micromatic Hydraulically Controlled Drawfinishing Tools generate final finish with all markings co-directional with the axis of the bore.

5. Micromatic Hydraulically Controlled Tubing Hones remove from .001" to .075" stock in bores up to 30" diameter x 75 feet long — generate accuracy within .0005" to .001".

6. Micromatic Hydraulically Controlled Hydrohones (with or without remote control) remove from .001" stock upwards in tubing and large diesel liners — generate accuracy within .001".

7. Micromatic Model 100 Hydrohoner with Automatic Microsize Control and Loading removes up to .002" or .003" stock in cast iron bores from ¼" to 1" diameter x 6" long — generates accuracy within .0001" to .0002" and size within .0005".

8. Micromatic Model 200 Hydrohoner removes up to .003" or .005" stock in cast iron bores from 1" to 2" diameter x 6" long — generates accuracy within .0001" to .0003".

9. Write for Bulletins AR-65 and AR-67.

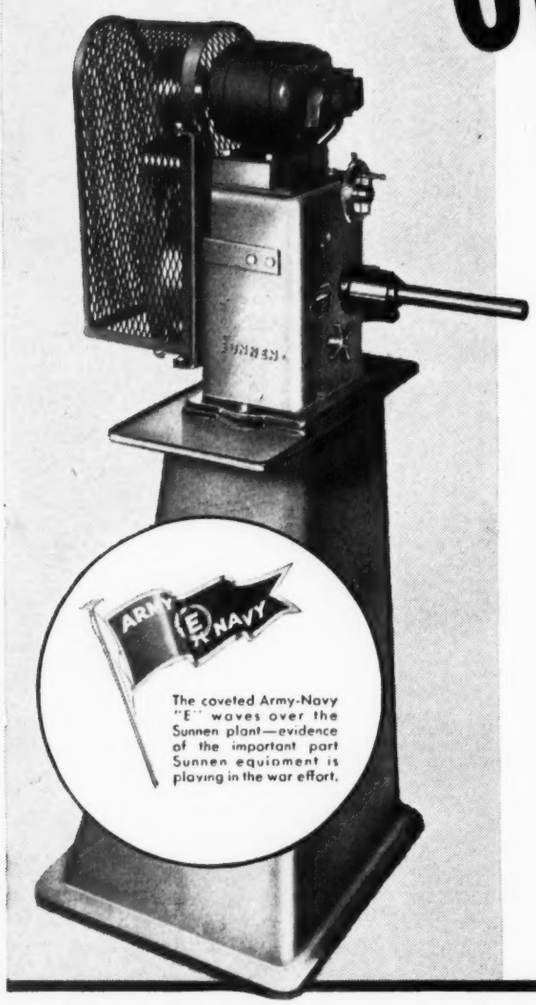
MICROMATIC HONE CORPORATION

Production Honing Needs

8100 Schoolcraft Ave., Detroit, Mich., U. S. A.

Sunnen Precision Honing Assures Absolute

INTERCHANGEABILITY OF PARTS!



The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

● While the Sunnen Precision Honing Machine is *guaranteed* to be accurate within "one-tenth"—*production jobs have been held to .000025"!*

This amazing accuracy — together with the super-smooth finish (of 2 to 3 micro-inches) — makes possible absolute interchangeability of parts, saving production time and conserving vital war materials!

And — the Sunnen method does not require skilled labor. Girls in "teens" can be trained to handle jobs in "tenths" in a few hours.

Consider These Important Advantages

The Sunnen Precision Honing Machine handles internal cylindrical surfaces from .185" to 2.400" in diameter. No jigs or fixtures needed — work is held in the hands.

Low in cost — economical to operate! Fast! Can be "set up" for any size in its range in less than a minute!

Facilitates duplication of sizes. Relieves big internal grinders for other jobs.

Let a Sunnen engineer check *your* job in your plant with this equipment. Or write for free bulletin giving detailed information.

SUNNEN PRODUCTS COMPANY
7940 Manchester Avenue St. Louis, Missouri
Canadian Factory: Chatham, Ontario

SUNNEN

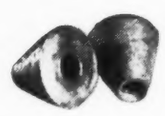
Aluminum Aircraft Link produces high finish without bell-mouthing.

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

"Strict alignment maintained between two holes."

Aircraft Valve Tappet Roller. 4-Micro finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.


Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Hardened Steel Ring Gauge—finished to an accuracy of .000025" for roundness and straightness.

Drill Jig Bushing "Increases sales appeal of product."

EVERY SUB COMMANDER KNOWS THE IMPORTANCE OF

Centralized Control

Instant response — unfailing action in every mechanical element of the ship — is vital to protect the lives of the crew as well as giving striking power to the submarine. From his station, the commander skillfully directs its performance through centralized control equipment.

★ ★ ★

The centralized controls of Milwaukee Milling Machines give the operator complete command of his machine — enable him to control its performance to the fine degree he demands for the full expression of his skill.

Speed and feed dials — all control levers within easy reach — the latter duplicated front and rear on plain and universal horizontal machines (model 2K and larger) — contribute to the sustained precision of Milwaukees, in the tool room or on the production line.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

Buy Victory with at least 10% in War Bonds!

MACHINE TOOLS

Both are LOADED with POWER

. . . and both Kinds of Power are Needed to Win

Why is a Whitney Roller Chain like a modern explosive bullet? Because you can load both of them with power and be sure that they will deliver *all of it* right to their objectives. Whitney Roller Chains are designed and constructed to take full power to the job, without slippage, at speeds that remain constant around the clock. And they are stoutly armored with special Whitney alloy steels for greatest strength under today's never-let-up conditions, with all the shocks and overloads that can be imposed. In fact, insofar as a chain can be so built, Whitney builds Roller Chains to serve as Victory Drives *for the duration.*

PROLONG Chain Life

Keep sprockets properly aligned, chains properly lubricated. And inspect all drives regularly

WHITNEY ROLLER CHAIN DRIVES

THE WHITNEY CHAIN & MFG. CO., HARTFORD, CONN.

HOW AND WHY

WILLIAMS' TOOLS AID WAR PRODUCTION

DATA ON "VULCAN" EYE BOLTS

● Eye Bolts are used extensively to facilitate the moving, installation and handling of machines, equipment, gigs, etc. Many designers place Eye Bolts at strategic locations on their machines to eliminate hazardous stresses that would cause torsional weave or misalignment of critical sections or surfaces. In addition to these common industrial uses, Eye Bolts are today widely used on such war equipment as guns, tanks and boats for lifting and towing purposes. Eye Bolt failure, in addition to endangering life, may cause damage to delicate or costly mechanisms. *Strength* and *Safety* are therefore the fundamental essentials of Eye Bolt design.

Williams' "Vulcan" Eye Bolts are weldless, being drop-forged from a solid blank of carbon steel. After forging they are heat-treated to further increase their strength and toughness and reduce liability of breakage. Every "Vulcan" Eye Bolt is then individually proof-tested on a standard tension machine to *fifty percent beyond* its rated "safe working load." Each Eye Bolt so tested and approved is stamped with the circular identifying mark shown in the illustration at left.

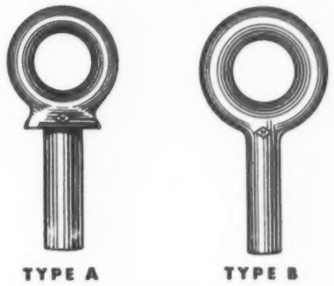
The following data is intended to help users in the selection of available standard patterns and sizes. These "Vulcan" Eye Bolts can be furnished blank, from stock. Plain and Shoulder Patterns are carried in stock threaded U. S. Std., but Miscellaneous Patterns must be threaded to order.

SHOULDER PATTERN "VULCAN"

No.	Shank: Diam.; Nominal Rough Size; Blank	Shank: Std. Lgth. under Shldr. Blank and Thd.	Shank: Maximum Lgth. in Stock; Blank	Eye, Diameter: Inside	Eye, Diameter: Outside	Capacity Blanks; Tons of 2000 lbs.: Safe Working Load	Capacity Blanks; Tons of 2000 lbs.: Breaking Strain, Apprx.
21	1/4	1	3	3/4	1 3/16	.2	1.5
22	5/16	1 1/8	4	7/8	1 7/16	.4	2.
23	3/8	1 1/4	4 1/2	1	1 21/32	.7	3.
24	7/16	1 3/8	4 1/2	1 3/32	1 27/32	1.	4.
25	1/2	1 1/2	4 1/2	1 3/16	2 1/16	1.3	5.
26	9/16	1 5/8	4 1/2	1 9/32	2 9/32	1.5	6.
27	5/8	1 3/4	4 1/2	1 3/8	2 1/2	2.	8.
28	3/4	2	5	1 1/2	2 13/16	3.	12.
29	7/8	2 1/4	5	1 11/16	3 1/4	3.5	16.
30	1	2 1/2	5	1 13/16	3 9/16	4.	20.
31	1 1/8	2 3/4	5	2	4	5.	23.
32	1 1/4	3	6	2 3/16	4 7/16	7.5	33.
34	1 1/2	3 1/2	6	2 1/2	5 3/16	9.	42.
35	1 3/4	3 3/4	6	2 7/8	6 1/16	11.	53.
36	2	4	6	3 1/4	6 7/8	13.	68.

PLAIN PATTERN "VULCAN"

No.	Shank: Diam.; Nominal Rough Size; Blank	Shank: Std. Length under Eye, Blank and Thd.	Shank: Maximum Length in Stock; Blank	Diameter Eye: Inside	Diameter Eye: Outside	Capacity Blanks; Tons of 2000 lbs.: Safe Working Load	Capacity Blanks; Tons of 2000 lbs.: Breaking Strain, Apprx.
3	3/8	1 1/4	4 1/2	1	1 21/32	.7	3.
4	7/16	1 3/8	4 1/2	1 3/32	1 27/32	1.	4.
5	1/2	1 1/2	4 1/2	1 3/16	2 1/16	1.3	5.
6	9/16	1 5/8	4 1/2	1 9/32	2 9/32	1.5	6.
7	5/8	1 3/4	4 1/2	1 3/8	2 1/2	2.	8.
8	3/4	2	5	1 1/2	2 13/16	3.	12.
9	7/8	2 1/4	5	1 11/16	3 1/4	3.5	16.
10	1	2 1/2	5	1 13/16	3 9/16	4.	20.
11	1 1/8	2 3/4	5	2	4	5.	23.
12	1 1/4	3	6	2 3/16	4 7/16	7.5	33.
14	1 1/2	3 1/2	6	2 1/2	5 3/16	9.	42.
15	1 3/4	3 3/4	6	2 7/8	6 1/16	11.	53.
16	2	4	6	3 1/4	6 7/8	13.	68.
17	2 1/2	5	6	4	8 9/16	16.	85.



TYPE A TYPE B

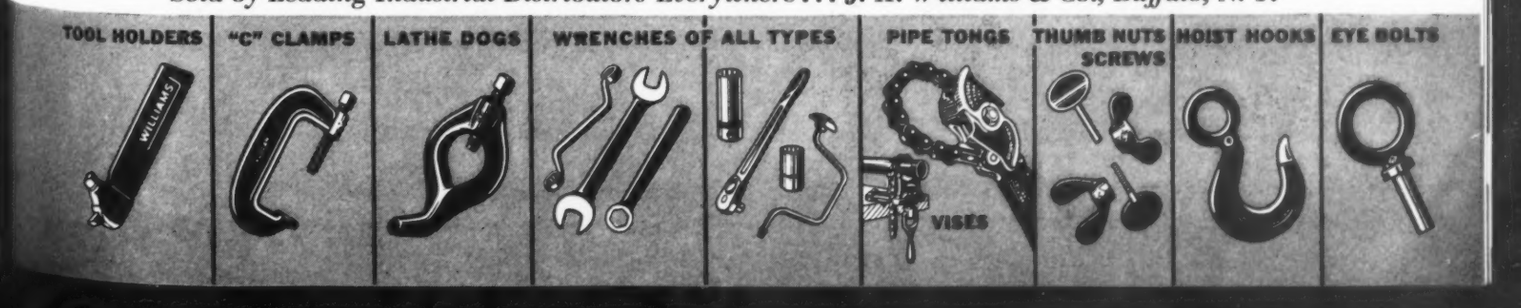
MISCELLANEOUS PATTERNS

These two styles are carried in stock blank (not threaded) in the following shank dimensions:

Type A, 1/4" x 3/4" to 1-1/16" x 4-1/8"
Type B, 1/4" x 1/2" to 1" x 2-3/4"

WILLIAMS
SUPERIOR DROP FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere . . . J. H. Williams & Co., Buffalo, N. Y.



Help s-t-r-e-t-c-h our Copper Supply by CONSERVATIVE GAMBLING

OUR COPPER STOCK PILE
WHAT SIZE MOTOR DO WE NEED FOR THAT NEW MACHINE?
IT FIGURES 12½ H.P. LET'S PLAY SAFE AND MAKE IT 15
BETTER PLAY STILL SAFER, MEN, AND MAKE IT 10 H.P. WE NEED THAT EXTRA COPPER FOR SHOOTING
RELIANCE

YES, COPPER'S NO. 1 JOB now is in "shooting" material. To keep the shooting going we must conserve behind the lines. Our part is to build more motor per pound of copper, and we are finding ways to do it.

Your part, in which we are ready to help, is to take extra care in picking the right motor to make sure that it is not bigger than needed.

Before ordering, check with these questions:

- Could you draw from your stock of spare motors?
- Any motors that could be taken from machines removed from production lines because of switching from peacetime to war work?
- Could you get by with an open motor in place of an enclosed fan-cooled motor which may have been included in your plans?
- Would an intermittent-duty motor in a size smaller frame serve instead of a continuous-duty motor?
- Could you alter gears or pulleys to use next higher speed and thus drop a frame size?

All of these mean *triple* savings: (1) man-hours, (2) machine-hours *and* (3) materials . . . copper, steel, aluminum.

Reliance men skilled in Application Engineering are ready to help in checking duty-cycles, torque requirements, speeds. Let them aid in fitting the right motor to your machine. That's a definite part of our business.

Two paragraphs from an ELECTRICAL WORLD Editorial headed "PLAYING SAFE"

We must take chances. We have no room today for the philosophy of playing safe. We are not playing safe with our boys in the services, why should we do differently with objects of copper and iron and rubber?

* * * *

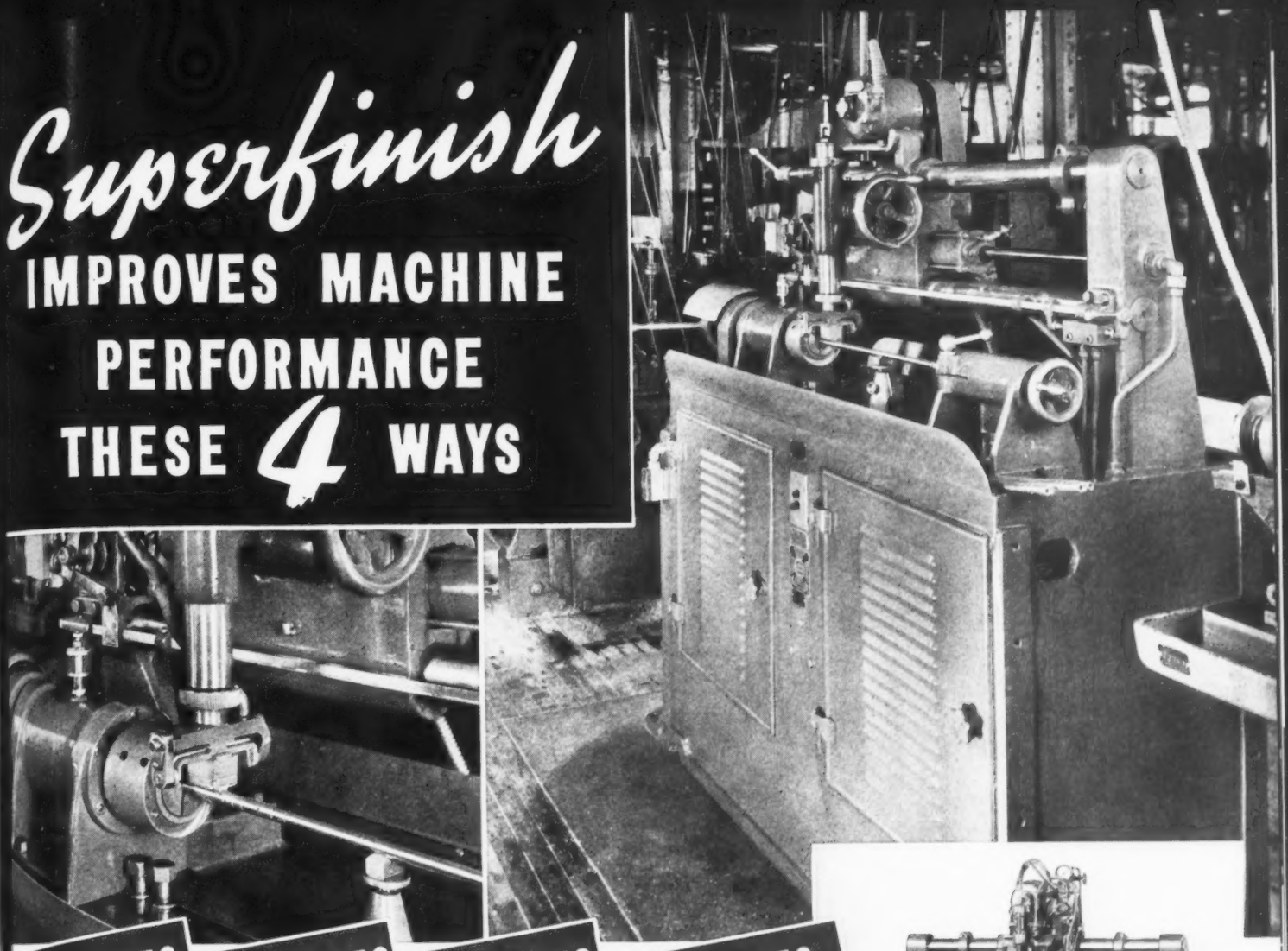
The expediency of war practice is not held up, as good for peacetime, although there is every likelihood that, as the result of what we learn, some of it will be carried over. It must be recognized and promoted for what it is — materials saving by not playing safe.

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 IVANHOE ROAD • CLEVELAND, OHIO

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI
DETROIT • GREENVILLE, S. C. • HOUSTON, TEXAS • LOS ANGELES
MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE.
ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. • and other principal cities

RELIANCE A-C D-C MOTORS

Superfinish
IMPROVES MACHINE PERFORMANCE THESE 4 WAYS



ELIMINATES RUN-IN PERIOD

ELIMINATES FRICTION HEAT

ELIMINATES BEARING WEAR

ELIMINATES VIBRATION AND CHATTER

(*Right*) Foster 4″ x 18″—4″ x 36″ General Purpose Superfinisher

Two drive spindles for sewing machines are superfinished on a Foster 4″ x 18″ General Purpose Superfinishing Machine with the above results. The main shaft is 16″ long x .57975″ dia., and the small shaft is .31275″ dia., and both are held within .0005″ tolerances after superfinishing. The main shaft is superfinished in 2 min. 20 sec., and the small shaft in 45 sec. floor-to-floor.

Foster builds two General Purpose Superfinishing Machines, sizes 4″ x 18″ and 4″ x 36″, which are designed to handle a wide range of cylindrical parts. They are capable of producing geometrically improved surfaces of 2 to 3 micro-inches as measured by a profilometer with .0001″ to .0002″ stock removal. This is of particular importance to small production shops and tool rooms.

Superfinish may be used to improve your product's performance, or it may serve to eliminate bearing troubles that have been causing you excessive service expense. International Engineers will be glad to discuss the application of Superfinish to your products and make recommendations without obligation.

Foster also builds Flat Surface, Special Superfinishing Machines, and four sizes of Superfinish Attachments for mounting on engine lathes and turret lathes.

GET THIS FREE BOOKLET

Superfinishing data explains advantages and many uses. . . shows extensive line of general purpose and special machines for miscellaneous or production superfinishing. Write to International Machine Tool Corporation, Foster Division, 1102 W. Beardsley Ave., Elkhart, Indiana.

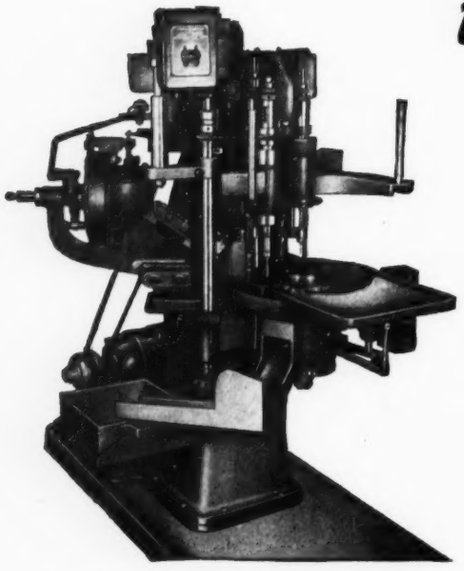
INTERNATIONAL MACHINE TOOL CORPORATION

FOSTER DIVISION, ELKHART, INDIANA · LIBBY DIVISION, INDIANAPOLIS, INDIANA

MAIN OFFICE AT ELKHART, INDIANA

FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS
SUPERFINISHING MACHINES · BARKER CHUCKS · UNIVERSAL RAM TYPE TURRET LATHES

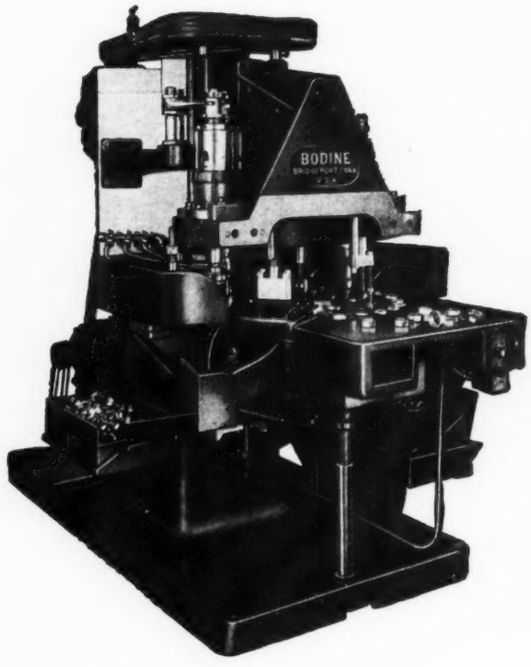
6 *to* 8 Tools operate *Simultaneously* *for* DRILLING, MILLING, TAPPING



Bodine automatic dial feed machines have been designed for high speed repetitive production of small parts . . . especially where several operations are required on each piece. For instance . . . spindles may be geared to drill large holes at one speed at the same time others are set for small holes at higher speeds. All three operations of drilling, milling and tapping may be performed during one cycle of the indexing dial with the tools vertical, horizontal or inverted. The work is fed to clamps on the horizontal indexing dial and automatically ejected when completed.

6 Machine Sizes

The #40-10 (left) only 54" x 60" and the #48-30 (right) are the minimum and maximum sizes. They carry 6 to 8 spindles for drilling and tapping holes from 1/4" to 1/2" dia., and 13/16" to 3-1/2" depth, at spindle speeds up to 20,000 r.p.m.

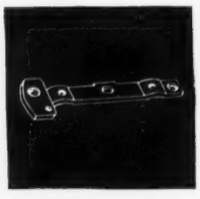


DIVERSITY OF OPERATIONS

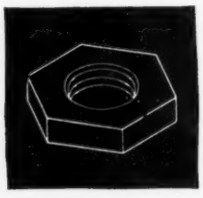
Many components, such as electrical wiring devices, require tapping, insertion of a binding screw, spinning of the screw and backing up. Under these conditions a combination tapping and screw inserting machine is provided, which feeds the screws through a hopper to transfer mechanism then to feed fingers under a screw-driving spindle. If the screw requires staking, an inverted spindle spins over the end at the next station on the dial. Then follows a backing-up spindle which positions the screw to receive the wiring. Any or all operations can be performed during one cycle of the dial.

This is but one example of the many possibilities of Bodine production. Note the six parts illustrated below which are being finished on one or other of the six Bodine machines.

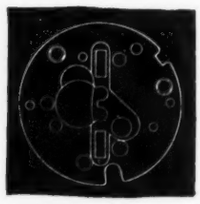
Bodine catalog on application, as well as specific engineering recommendations from your blueprints or sample of work.



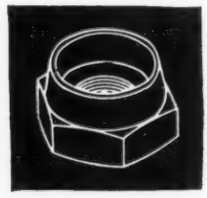
Jewel plate. 6 operations at one handling.



Stainless steel hex. nut, tapped and retapped.



Delicate ordnance part. 7 holes drilled.



Special nut, drilled and tapped.

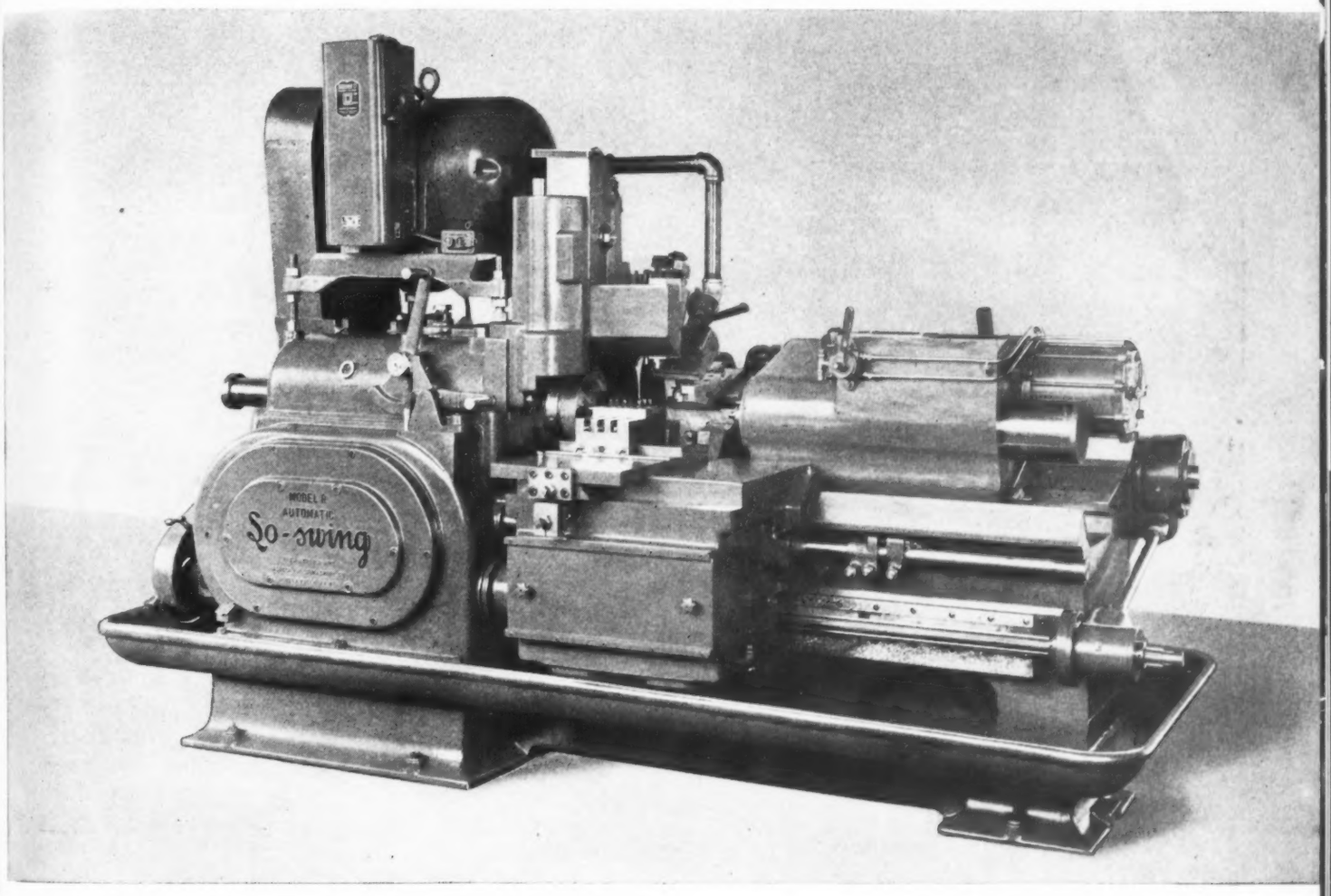
Contact blade for attachment plug cap. 6-32 hole tapped, screw inserted, "staked" on end, screw backed up and ejected.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Pipe union nut, core-drilled then threaded with collapsible taps to speed production. Hand fed, automatically ejected.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE *Lo-swing* PEOPLE"** SENECA FALLS, NEW YORK



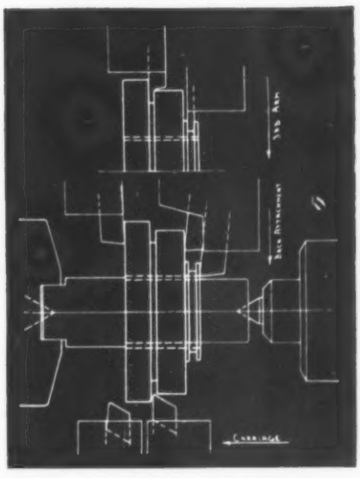
HEAVY TRACTOR GEARS, IN A WIDE VARIETY OF SIZES, ARE TURNED, FACED AND GROOVED ON A SINGLE MODEL R-14 *Lo-swing* LATHE

Problem: To provide a single automatic lathe capable of turning, facing and grooving a variety of sizes of heavy steel gears and requiring minimum change-over time from job to job.

Solution: The R-14 *Lo-swing* Lathe was chosen for this job primarily because it had the power and capacity necessary to handle heavy steel gears, varying in size from 4¼ to approximately 10″ diameter. The built-in, Quick Change-over Mechanism on this lathe also provided a simple and speedy means for varying the carriage stroke, as required for each individual gear job.

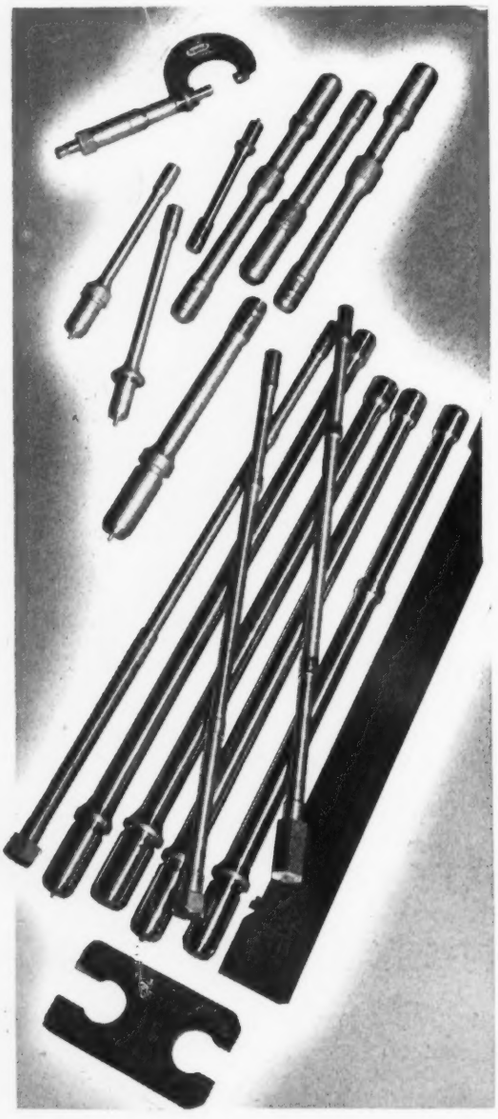
Forged gear blanks come to the lathe with only the hole finished. Drive is by arbor through this hole as seen in the drawing opposite which illustrates typical tooling for one of the gears.

In order to simplify tooling, this Model R-14 *Lo-swing* was equipped with a standard Third Slide or Overarm which carries the grooving tools. Turning is accomplished with the Front Carriage tools while tools on the Back Attachment face the sides of the gears.



LATHE NEWS from SENECA FALLS

PACKARD MOTOR USES BATTERIES OF MODEL B CLEVELAND *Single Spindle* AUTOMATICS TO PRODUCE AIRCRAFT ENGINE STUDS RAPIDLY



• Perhaps in no other industry has the Model B Cleveland *Single Spindle* Automatic been given so much responsibility for a vital war production job as at Packard Motor Car Company, "on the toughest job we ever tackled," says Packard. Here the problem of producing studs accurately and quickly for the famous Rolls Royce aircraft engine has been solved by using Model B Cleveland for just that one purpose—in step with American production methods and yet with Packard precision standards always in mind.

A large number of Model B Clevelands are on the job, and Packard production men have indicated their entire satisfaction with Model B performance by ordering more for future delivery.

Typical of the work is the production cycle for one of the Rolls Royce engine studs shown, produced from 1⅜-inch bar stock. Operations include turning long undercut, turning stud end, forming, chamfering, small undercut, turning nut end and cutting off. Close tolerances are easily held.

Built in short and long lengths, up to 18-inch stock feed, and from 1 1/16-inch to 2½-inch bar stock capacity, Model B can be equipped with hopper-feed or rotary tilting magazines for secondary operations. Cutting tools can be mounted singly or in series for turning one or more diameters of various lengths. Model B has double cross slides for forming tools and overhead slide for independent cut-off.

Where shafts of multiple diameters, various types of studs, nipples, tap blanks and pins are to be produced rapidly in quantity, Model B Cleveland *Single Spindle* Automatics solve tough problems in many metal working plants throughout this country and overseas. *Small lots and short runs* are of course ideally suited to Cleveland *Single Spindle* Automatic operation.

Ask for descriptive literature giving complete information on the utility and flexibility of Model B Clevelands.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

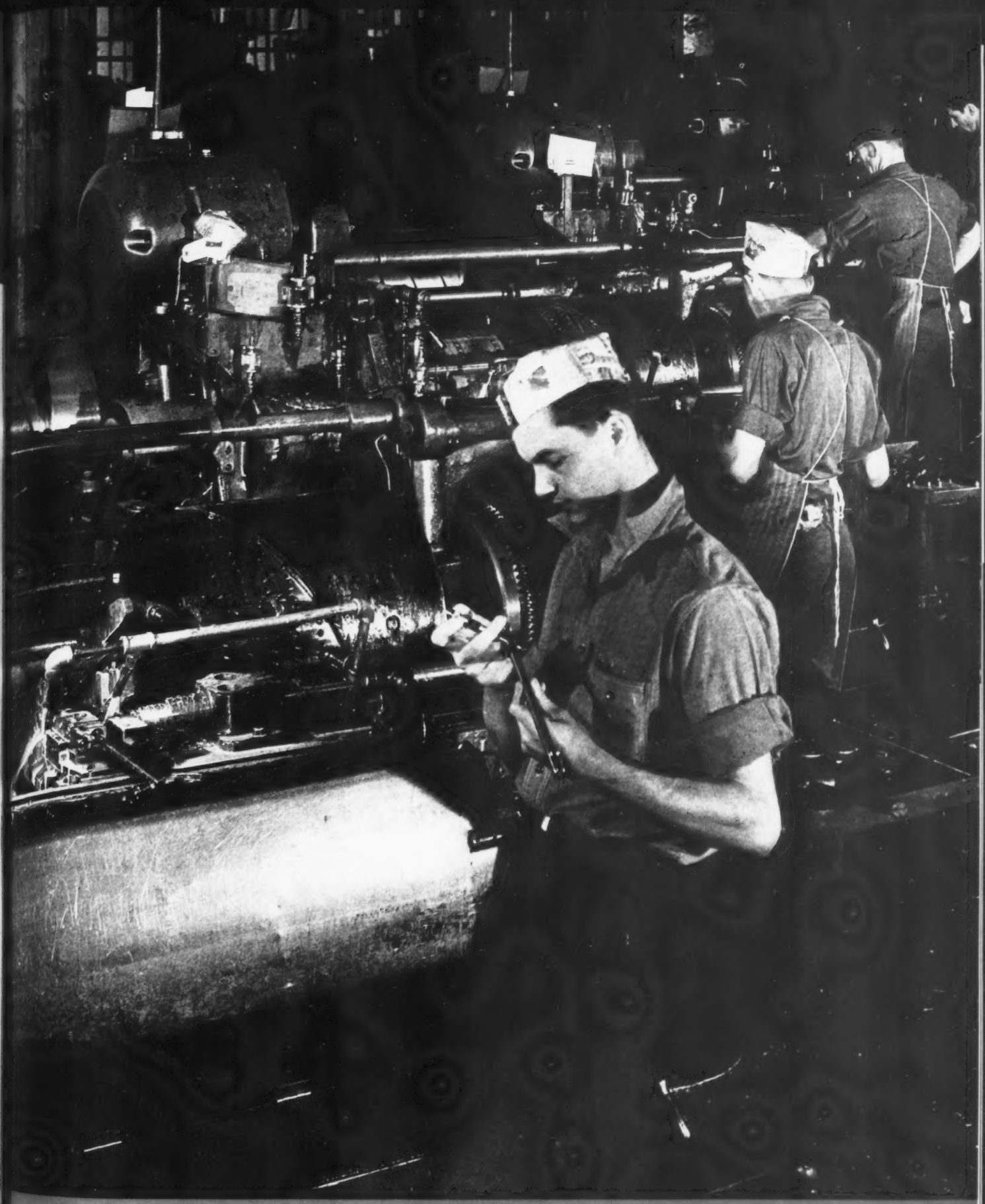
2269 ASHLAND ROAD • CLEVELAND, OHIO

Sales Offices: CHICAGO: 20 North Wacker Drive, Civic Opera Bldg., Room 1408

DETROIT: 540 New Center Building • NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland** *Single Spindle* **Automatics if you make duplicate parts in small quantities. By using** *single spindle* **automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**



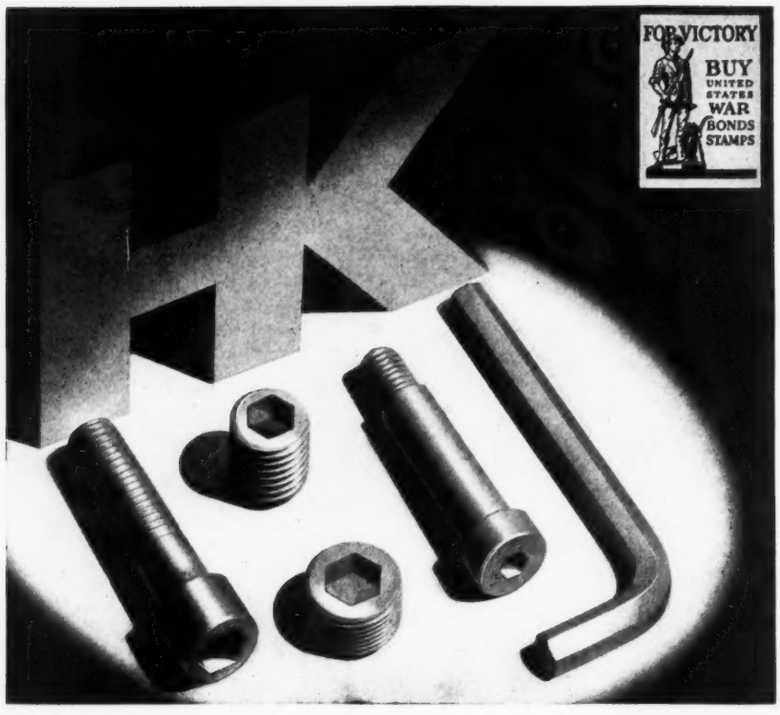
8

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 1 1/16-inch to 9 1/2-inch capacities inclusive

MODEL B—Built in 1 1/16-inch to 2 1/2-inch capacities inclusive

GUARANTEED *Unfailing* PERFORMANCE



Completely Cold Forged

HOLO-KROME FIBRO FORGED Socket Screws are guaranteed by Holo-Krome to give Unfailing Performance—the kind of performance demanded today on every front line of Industrial War Production.

Unfailing Performance is Guaranteed by Holo-Krome because of the superior method patented and exclusively used by Holo-Krome in the production of these **PRECISION MADE SCREWS.**

WRITE FOR CATALOG OF SOCKET SCREW STANDARDS

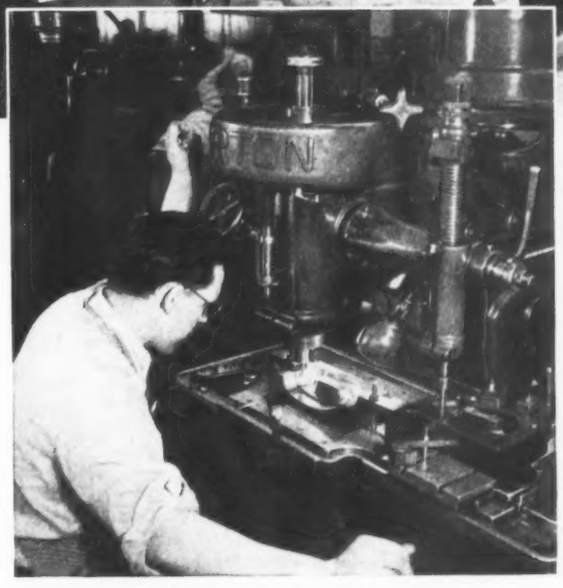
HOLO-KROME
TRADE MARK
fibro forged **SOCKET SCREWS**
THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

GORTON Equipped TOOL ROOM

HOW SPECIALIZED TOOL ROOMS HAVE *Standardized with* GORTON

MACHINES *Matched Equipment* ACCESSORIES

"Made for Each Other"



TO INCREASE *Accuracy and Output*

Where "***performance of the first machine determines selection of the second,***" a large manufacturer of molded products uses Gorton Super-Speed Milling Machines for producing and duplicating molds, and incidental jigs and fixtures for plastic molding.

This Gorton standardized installation is typical of many similar. A glance at the above photo shows the predominance of Gorton Machines. Closer inspection of this modern, efficient tool room, generally regarded as one of the finest and best equipped in the plastics industry, discloses that it is completely outfitted with Gorton time-saving Accessories—Vises, Circular Tables and Cutting Tools, etc.—a "Matched Equipment" installation, setting new standards of efficiency for high-speed spindle jobs.

Gorton Super-Speed Precision Machines and Accessories are increasing production and improving accuracy in Tool Rooms and Production Plants throughout the country. Perhaps they can also help you secure better results.

FREE DATA AND ENGINEERING SERVICE

Our engineers will be glad to make suggestions and recommendations on your high-speed milling, duplicating and pantograph work without obligation. Send for our complete catalogs covering all types of Super-Speed Vertical Milling, Duplicating and Pantograph Engraving Machines. Ask for complete set of catalogs.

ONE JOB IN BRIEF

TYPICAL of one of the many operations performed in the tool room shown above, is the machining of a cavity of a section of mold for producing plastic handles. A brief outline of the job is as follows:

MACHINE—Gorton 9-J Vertical Milling Machine.

PART—Section of Mold for producing plastic handles.

MATERIAL—Crucible Steel Co. CSM #2.

CUTTER—Right hand cut; right hand spiral ¾" end mill.

OPERATION—Machining out cavity of section for plastic handle. Molding section and master fastened on top of Duplicator Table.

FEED—In this case the feed and speed, which naturally must be varied, are controlled by the operator.

CUSTOMER SAYS: "Through the use of the Gorton Machine, it is possible for the operator to cut very close to the required dimensions, thus reducing the amount of hand finishing to the minimum."

GEORGE GORTON MACHINE CO.

1316 RACINE STREET, RACINE, WISCONSIN, U.S.A.

50 Years

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

CLOSE CYLINDER VALVE WHEN SHUTTING DOWN

Your regulators are built to give long, dependable service but careless treatment shortens their useful life. It's only sound common sense to give mechanical apparatus the best of care, and today it is essential because replacements are scarce.

For example, always close the cylinder valve when shutting down for long periods. Even if it's only for four or five hours, this precaution removes needless strain on the regulator seat. Repeated several times a week, these sensible "rest periods" add up to a valuable extension in regulator service.

Closing the regulator adjusting screw while setting up a new job is another way to prevent unnecessary wear on your apparatus. This step only takes a minute and eliminates useless pressure on hose and torch valves.

Make yourself a Waste Warden! Stay on guard against careless wear and wasteful practices. Take good care of your apparatus — keep every cubic foot of oxygen and acetylene working for America's smashing victory ahead!

WASTE WARDEN says
"Return Cylinders Promptly" and:

DO close cylinder valve after use.
DO check your hose and connections for leaks.
DO keep your cylinder inventory low.
DO keep tips clean and free from carbon and slag.

★ ★ ★

DON'T use excessive pressure.
DON'T use oversize tip.
DON'T leave torch burning when not in use.

Air Reduction

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AIRCO

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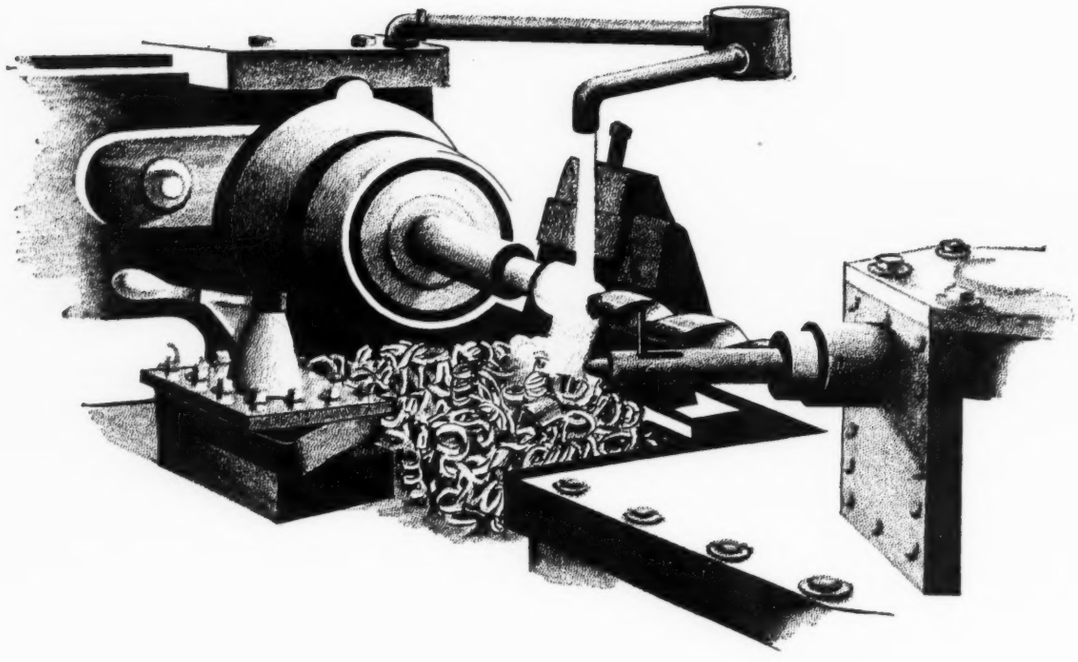
IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

TOUGH GOING
. . . but they can TAKE IT!
KEMPSMITH
ADAPTING KEMPSMITH NO. 2 FOR HEAVY DUTY FACE MILLING JOB . . .
This standard No. 2 Kempsmith Type G Miller, equipped with heavy duty vertical attachment and 12" dia. face milling cutter, is removing ¼" stock from a semi-steel gear case. Just another example of power and ruggedness, typical of all Kempsmith Millers during the past 54 years.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH
Precision Built Milling Machines Since 1888

Keep The STUTTER

Out of Your CUTTER



. . . Best bet is to check your cutting fluid. For while there are many machining operations, there can be only one *correct* cutting oil for your particular job. That's the coolant that delivers the "tops" in speed, finish, and tool life.

The difference between a "top" lubricant and one of ordinary quality means much these days of high speed, precision production. Particularly because many manufacturers are working many different types of materials, each presenting a new cutting oil problem. Cities Service Chillo Cutting Oils and Cities Service lubrication engineers have solved many of these problems and are continuing to do so daily. Why not find out what this combination will do for you? A consultation will cost you nothing. A copy of a new booklet, on "Metal Cutting Lubrication," will be sent free to users of cutting oils.

Just drop us a line or get in touch with the nearest Cities Service office. There is no obligation, of course!

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ARKANSAS FUEL OIL COMPANY
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ARMY E NAVY

The TESTMASTER

REG. U. S. PAT. OFF.

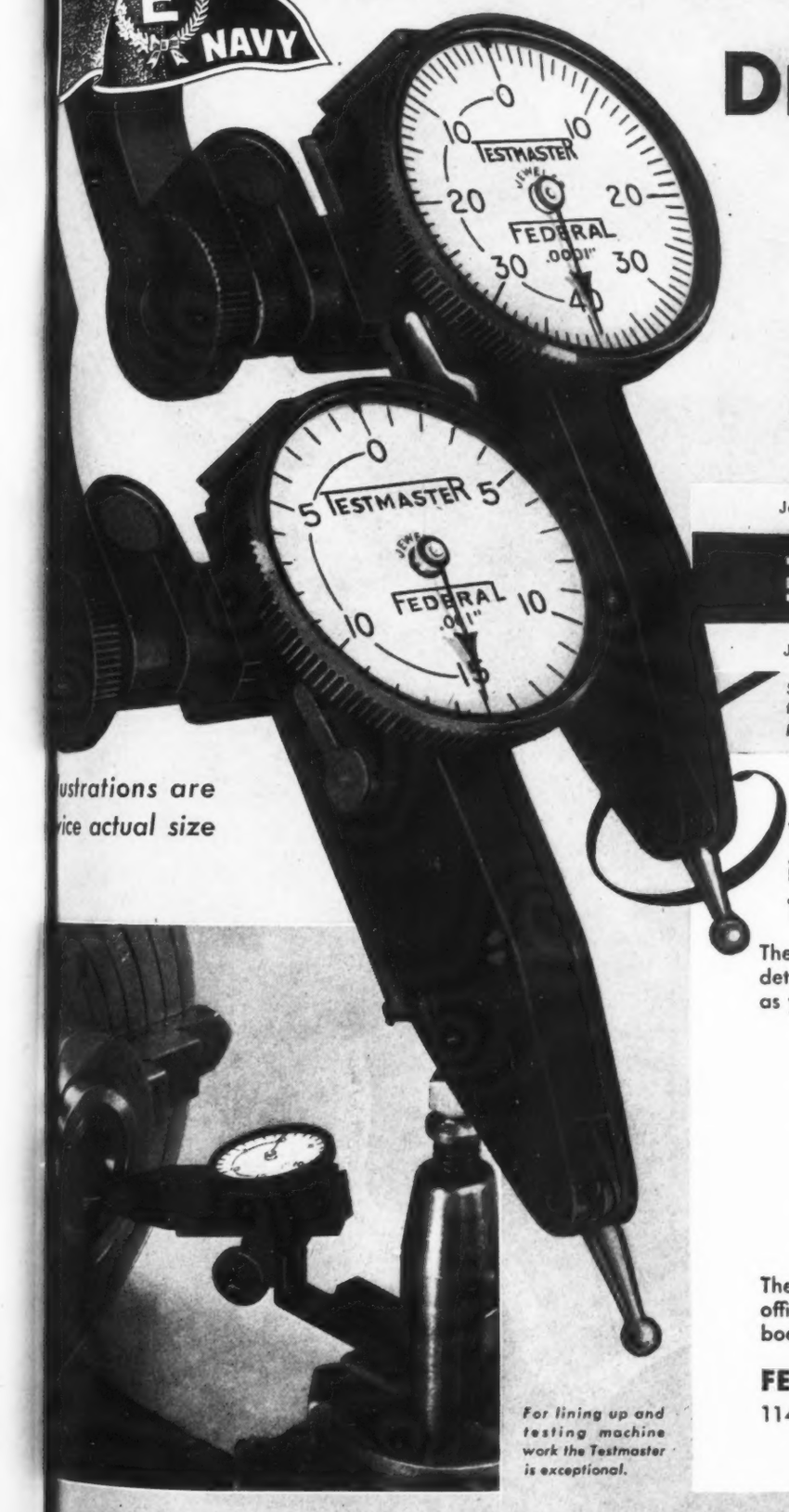
UNIVERSAL

DIAL INDICATOR

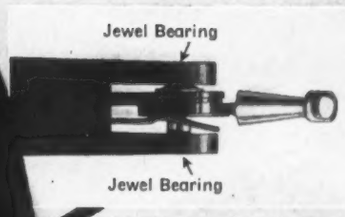
with the NEW

INDEX POINT

that locks in place and sets positively



Illustrations are twice actual size



Serrations mesh positively. Interchangeable point locks on pivot. Low friction bearings.

Crown gear reduces friction and inertia — greater accuracy.

For lining up and testing machine work the Testmaster is exceptional.

You get more quality features in this *new* FEDERAL Universal Test Indicator.

The Testmaster universal test Indicator is chock full of detail features that you will appreciate more and more as you use it.

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Fourth — The universal clamp enables setting in any position (other holding bars can be substituted).

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Sixth — Its quality is worth more than the price.

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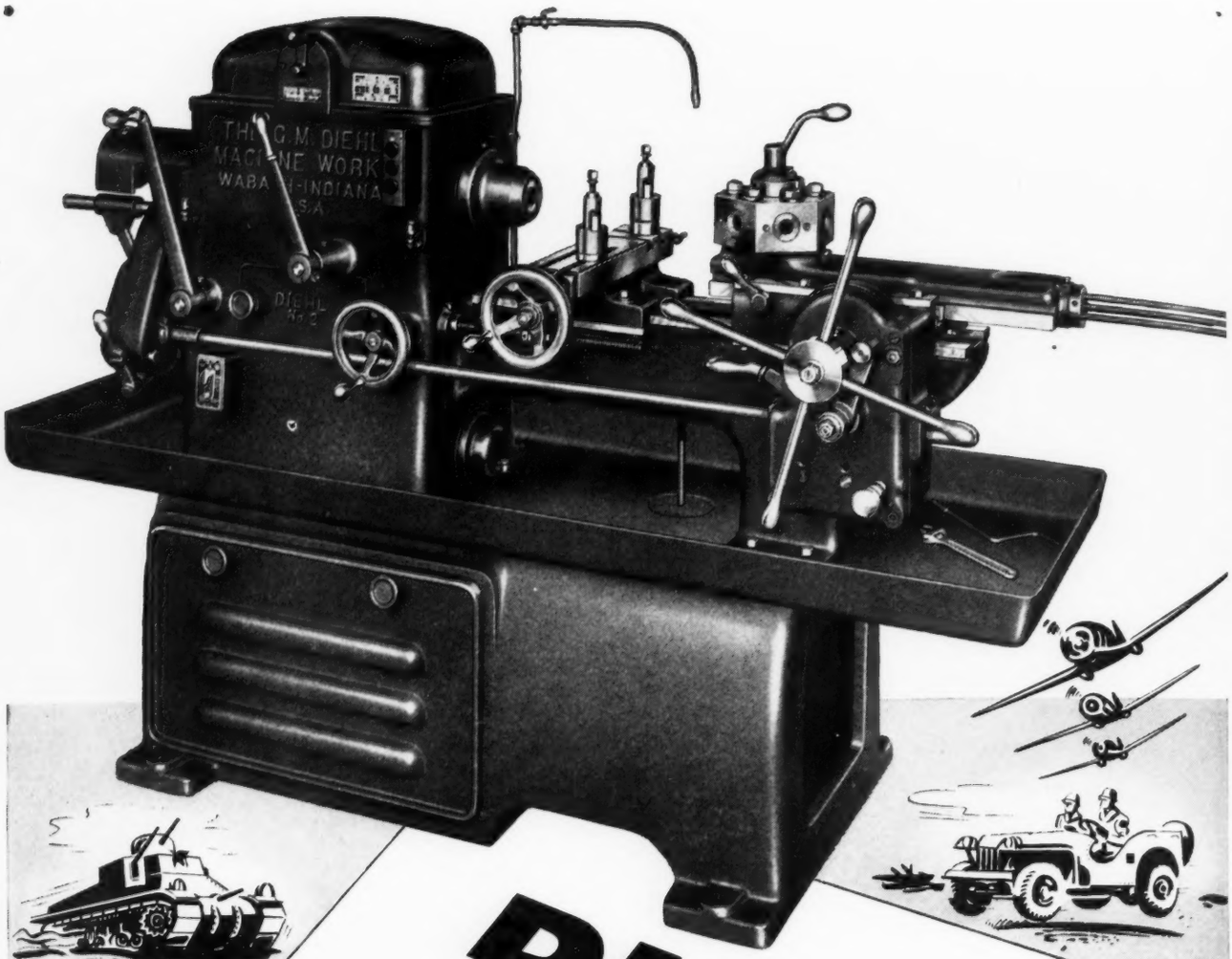

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The planes, tanks and guns that roll off the production lines for our fighting forces and our allies can only be as good as the machines that make them. The battle-front arms and the equipment that produce them must be the best. Diehl Power Feed No. 2 Turret Lathe is designed for high speed, precision war production and works alongside any other No. 2 lathe of standard make, using same tooling, including collets. Automatic chuck capacity (round) 1" . . . swing-over cross slide, 6" . . . over bed, 14". Six speeds, forward and reverse. Write for complete specifications and illustrated brochure.

Where precision craftmanship is honored

The G. M. DIEHL MACHINE WORKS Wabash, Indiana

the light metal age is born . . .

The Stone Age, the Bronze Age, the Iron Age, the Steel Age — these four great ages span the history of man.

Today, we are at the dawn of a fifth. Out of this war, the greatest conflict the world has ever known, the Light Metal Age is being born.

Magnesium is one of the lightest metals known. One pound will do the work of one and one half pounds of aluminum and five pounds of copper, and magnesium alloys have been developed with an ultimate strength of more than 60,000 pounds per square inch.

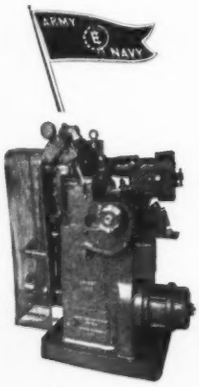
Before the war there was only one magnesium and one aluminum producer in the United States . . . after the war there will be as many as ten magnesium producers and four aluminum producers! What's more, these metals are among the most abundant of all, and full production should reduce the prices of both to levels never dreamed of before.

Likewise in steel, in just two war years our capacity for electric-furnace steel has increased an incredible 85%, and new lightweight superstrength alloys have been developed which can now be welded, with great savings in costs and time.

What does all this mean to the post-war world just ahead? It means that aircraft, automobiles, trucks and trains will be lighter, stronger and cheaper. It means that rivetless ships will slide off the ways, and rivetless planes will roll off the lines. It means greater speed and lightness and strength and economy.

And it means *problems!* Problems in production, in fabrication, in tooling and in design. Problems in the new light metals of the new Light Metal Age!

Bryant engineers are among the foremost authorities in America on problems involving machine tool operations with the new light metals. Send us *your* problems now!



SEND FOR THE MAN FROM BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

For better results in Oxy-Acetylene Machine-Cutting Operations . . . Send for this Descriptive Chart

SEVEN WAYS TO INCREASE MACHINE-CUTTING ACCURACY
1. Correct Cutting Technique. The surface is plane and regular, and the drag lines are practically vertical. The slight amount of adhering scale at the top of the cut due to the action of the preheat flames can be easily chipped off. This is an excellent surface and for many purposes can be used without machining.
2. Cutting Speed Too Low. Here there is an excessive undercutting and adhesion of molten slag resulting in an extremely irregular surface. Also, with too low a cutting speed, there is an undue waste of oxygen and acetylene.
3. Cutting Speed Too High. Excessive cutting speed is shown by the angle of take of the drag lines. Nevertheless, the surface is reasonably smooth and for normal production work would be satisfactory. However, there is danger of losing the cut, if the speed is increased above that indicated by this photograph.
4. Nozzle Too Far From Work. This results in excessive melting of the top edge. When cutting at normal speed and with correct nozzle clearance, the preheat flames should be in contact with the plate surface. At greater clearances, the heat is drawn in by the aspirating effect of the oxygen stream.
5. Nozzle Too Near The Work. In order to prevent popping of the flame, an excessive preheat flame has been used. A portion of the preheat cone burns inside the kerf, resulting in an unstable cutting action. This produces grooves and exaggerated drag lines.
6. Excess Cutting Oxygen. The combustion of steel follows the pattern of the oxygen stream. For a given nozzle size, excess oxygen consumption is caused by excessive oxygen pressure which, in turn, causes excessive expansion immediately below the orifice. This results in a distorted and roughly cut.
7. Excess Preheat Flame. Inexperienced operators frequently endeavor to speed up the cut by using an excessive preheat flame. This does not affect speed of cutting, but merely serves to fuse the top edge of the metal. In addition, there is an unnecessary waste of gases.
8. Dirty Nozzle Used. The nozzle here has been fouled by some adhering scale with the result that the oxygen stream has lost its parallel form and the surface of the cut is no longer clear and regular. There is evidence of pitting, undercutting, and excessive scale. This can be remedied by cleaning the nozzle.
THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
New York and UCC Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

Good results in oxy-acetylene machine-cutting depend not only upon the use of efficient equipment, but also upon flame adjustment, oxygen and acetylene pressures, cutting speeds, and correct operation of the machine. The chart illustrated is a convenient reference containing helpful information on how to increase machine-cutting accuracy. One photograph shows the excellent surface obtained as a result of correct cutting techniques. The other photographs clearly show the results of some of the most common faults of machine-cutting procedures. Operators can use this chart as a means of comparing the actual results of their cutting operations, and thereby help to maintain a high level of workmanship. Large reprints (9 by 11¼ inches) of these charts are available from any Linde office without charge. Ask for Form 4346.

Instruction Literature

For information on correct gas pressures, nozzle sizes, and cutting speeds, refer to the Instructions furnished with your Oxweld cutting machines. Duplicate copies of these Instructions are available from any Linde office.

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

General Office: New York, N. Y. UCC Offices in Principal Cities

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OXWELD, PUROX, PREST-O-WELD APPARATUS . . . OXWELD SUPPLIES

The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

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Self-Opening
Die Head

Type 'M'
Collapsible
Tap

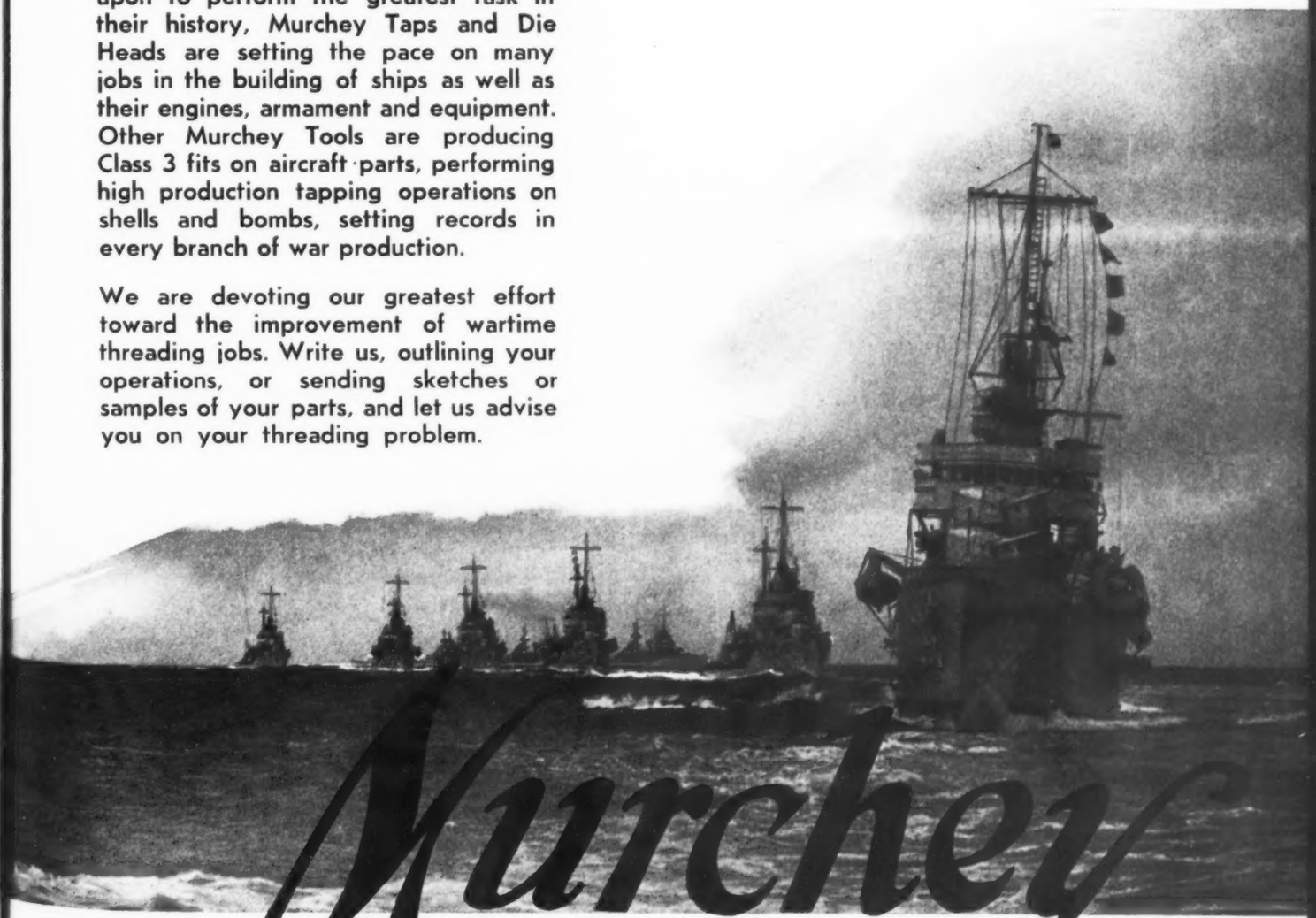
Type 'CO'
Self-Opening
Die Head

MURCHEY THREADING TOOLS

Pace-Setters on Naval and Maritime Threading Jobs

With machines and tools being called upon to perform the greatest task in their history, Murchey Taps and Die Heads are setting the pace on many jobs in the building of ships as well as their engines, armament and equipment. Other Murchey Tools are producing Class 3 fits on aircraft parts, performing high production tapping operations on shells and bombs, setting records in every branch of war production.

We are devoting our greatest effort toward the improvement of wartime threading jobs. Write us, outlining your operations, or sending sketches or samples of your parts, and let us advise you on your threading problem.



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CUT → MACHINING TIME
→ SET UP TIME

No. 3A DUOMATIC Performance Features

Fully automatic in operation—especially trained operator unnecessary.

Any combination of straight turning or angular "in" or "out" facing cycles, obtainable front or rear, simultaneously or independently.

Graduated tool slides can be swiveled to any angle, front or rear.

Independent mechanical feed and traverse mechanism—front or rear.

Front and rear cycles quickly changed over to suit the jobs—only simple mechanical adjustments required.

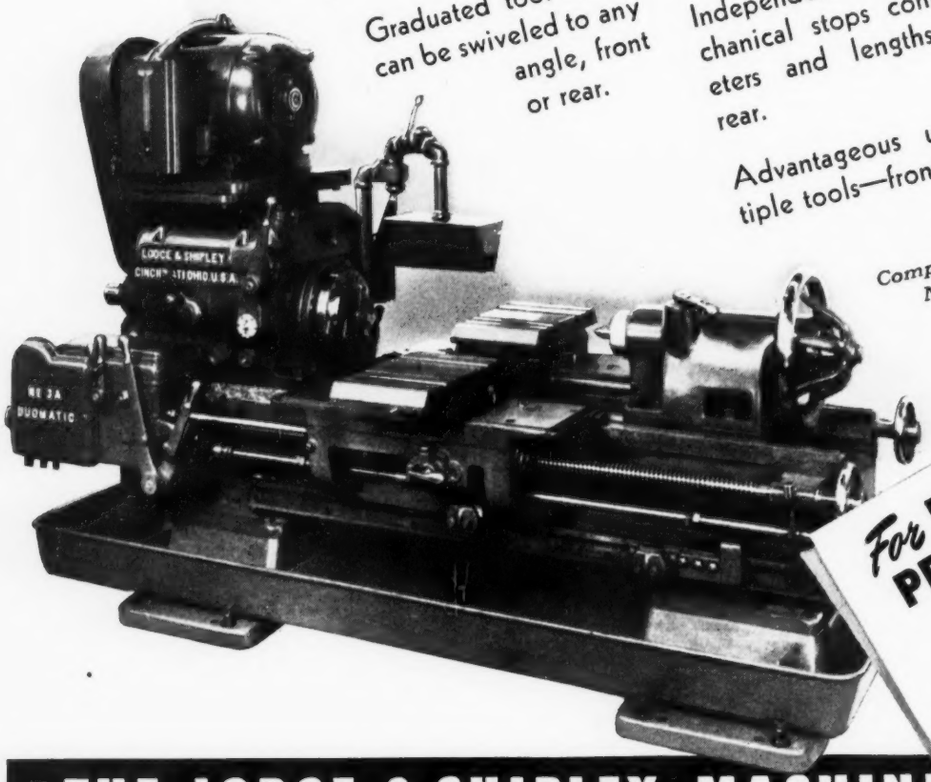
Controls duplicated front and rear.

Independent positive mechanical stops control diameters and lengths, front or rear.

Advantageous use of multiple tools—front and rear.

Write for Comprehensive Booklet No. 601-FL-742

Proudly worn since March 6, 1942



For **EFFICIENT PRODUCTION** *-in large or small lots!*

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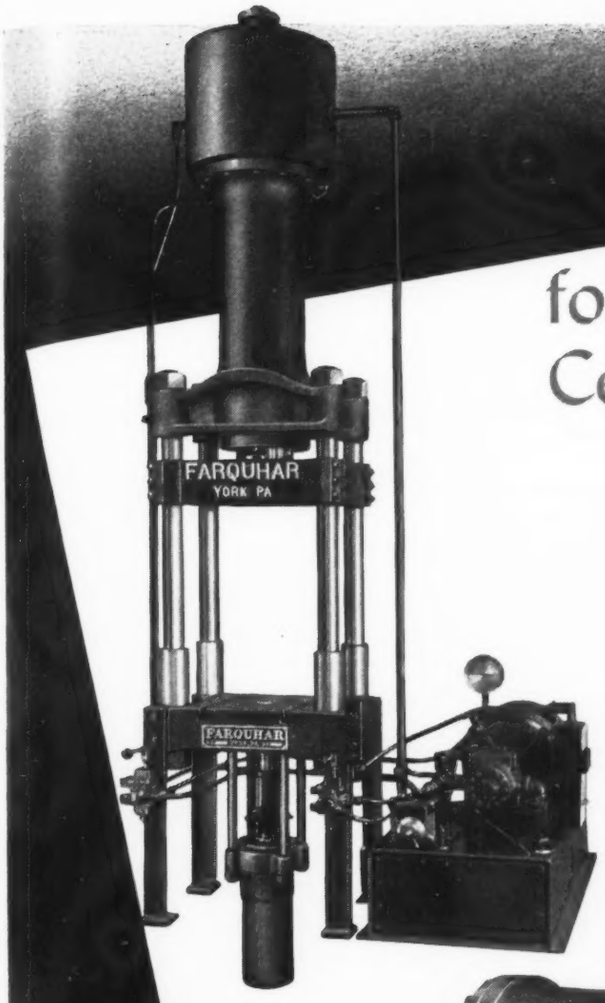
ENGINE TOOL ROOM AUTOMATIC LATHES



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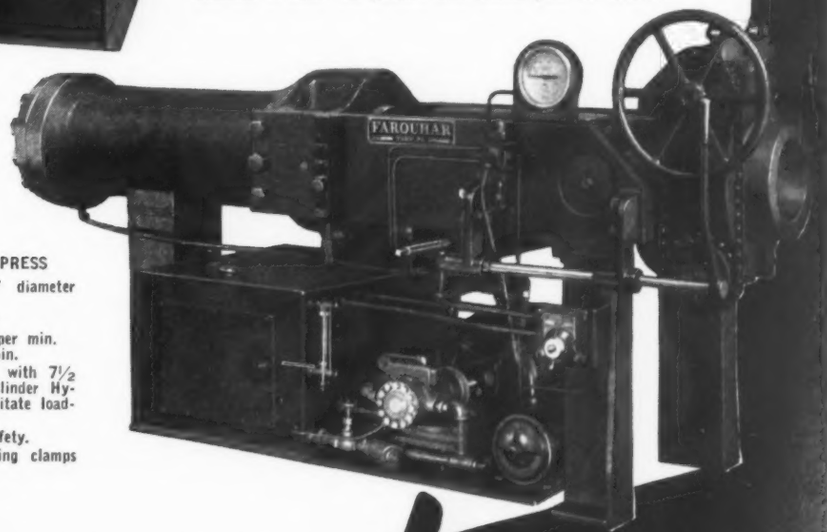
FARQUHAR builds all types of self contained Hydraulic Production Presses in capacities from three to 7,200 tons . . . builds for war today—ready for peace tomorrow.

	60 TON DOUBLE COMPRESSION PRESS	100 TON DOUBLE COMPRESSION PRESS*
Bed and Slide	18″ x 18″	21″ x 18½″
Daylight	28″	35″
Stroke of Slide	20″ (adjustable)	20″ (adjustable)
Bottom Cylinder	20 ton (adjustable)	20 ton (adjustable)
Bottom Cylinder Stroke	0″ to 12″ (adjust.)	0″ to 12″ (adjust.)
Speeds—Upper slide: closing	240″ per min.	250″ per min.
pressing	25″ per min.	27″ per min.
return	135″ per min.	185″ per min.
Bottom Cylinder: upward	30″ per min.	19″ x 188″ per min.
downward	80″ per min.	290″ per min.
Pump Unit	10 H. P. Motor	15 H. P. Motor

* Press equipped with spring preloaded hold down plate 19″ x 18″ attached to slide. Bed provided with Bolster plate 18″ x 18″.



100 TON EXTRUSION PRESS

Material Chamber — 10″ diameter 38½″ long
Hydraulic Ram Stroke 40″
Speed: Forward 0″—14″ per min. Return—26″ per min.
Pump unit, self contained with 7½ H. P. Motor Material Cylinder Hydraulically tilted to facilitate loading.
Electrical interlocks for safety.
Equipped with quick opening clamps for die changing.

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WAGNER MOTORS

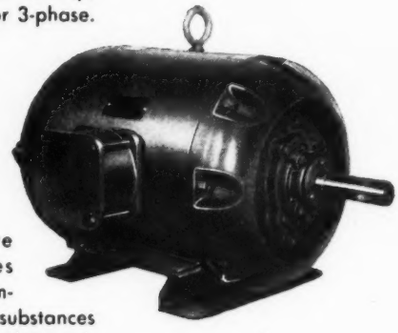
can help you in your "All-Out" War Effort!

Because Wagner motors have proved their reliability and efficiency in pre-war days on all kinds of motor driven equipment, thousands of them have already gone into war service. Today you will find Wagner motors driving all types of machine tools and other motor driven equipment in war industries, army cantonments, navy yards, air fields, and on ships – delivering the same dependable service that has established Wagner's outstanding reputation for high-quality motors.

Wagner's plant is working day and night, turning out more motors now than ever before, and is supplying these dependable motors wherever they are needed to help in the "all-out" war effort.

No matter what your motor requirements are . . . regardless of the torque, speed, or current requirements, you can choose a motor from the Wagner line that is correctly engineered for the job. The three motors illustrated represent just a few of the various types of Wagner motors. Each motor has special electrical and mechanical characteristics that make it the ideal motor for certain applications.

Type RP Squirrel-Cage motors are used on machine tools and other electrically driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycles, 2- or 3-phase.



Type HP motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125-hp, 2- or 3-phase, 25 to 60 cycles.

Type RA Repulsion-Start-Induction motors are single-phase brush-lifting motors having high starting-torque and low starting-current. They are ideal for heavy-duty applications. Obtainable in various speeds, frequencies, and voltages; rigid or resilient mounted; 1/8 to 15-hp, 25 to 60 cycles.

FIELD ENGINEERING SERVICE!

★ ★ ★ ★ ★ ★ ★

Today, with production at an all time high, you cannot afford to "take a chance" on motor efficiency. Shutdowns because of motor failure cannot be tolerated. Provide all your machine tools and electrically driven equipment with Wagner motors.

Wagner's 25 branch offices are manned by trained field engineers, competent to solve your motor application problems. They will gladly consult with you and do everything possible to assure you the quickest delivery on the motors you need to keep your war production schedule on time in this "all-out" war effort.

Send for THESE VALUABLE BULLETINS!

Bulletins MU-176, MU-182, MU-183 illustrate and describe the complete line of Wagner motors—a motor for every purpose. Copies of these bulletins will be sent you on request.

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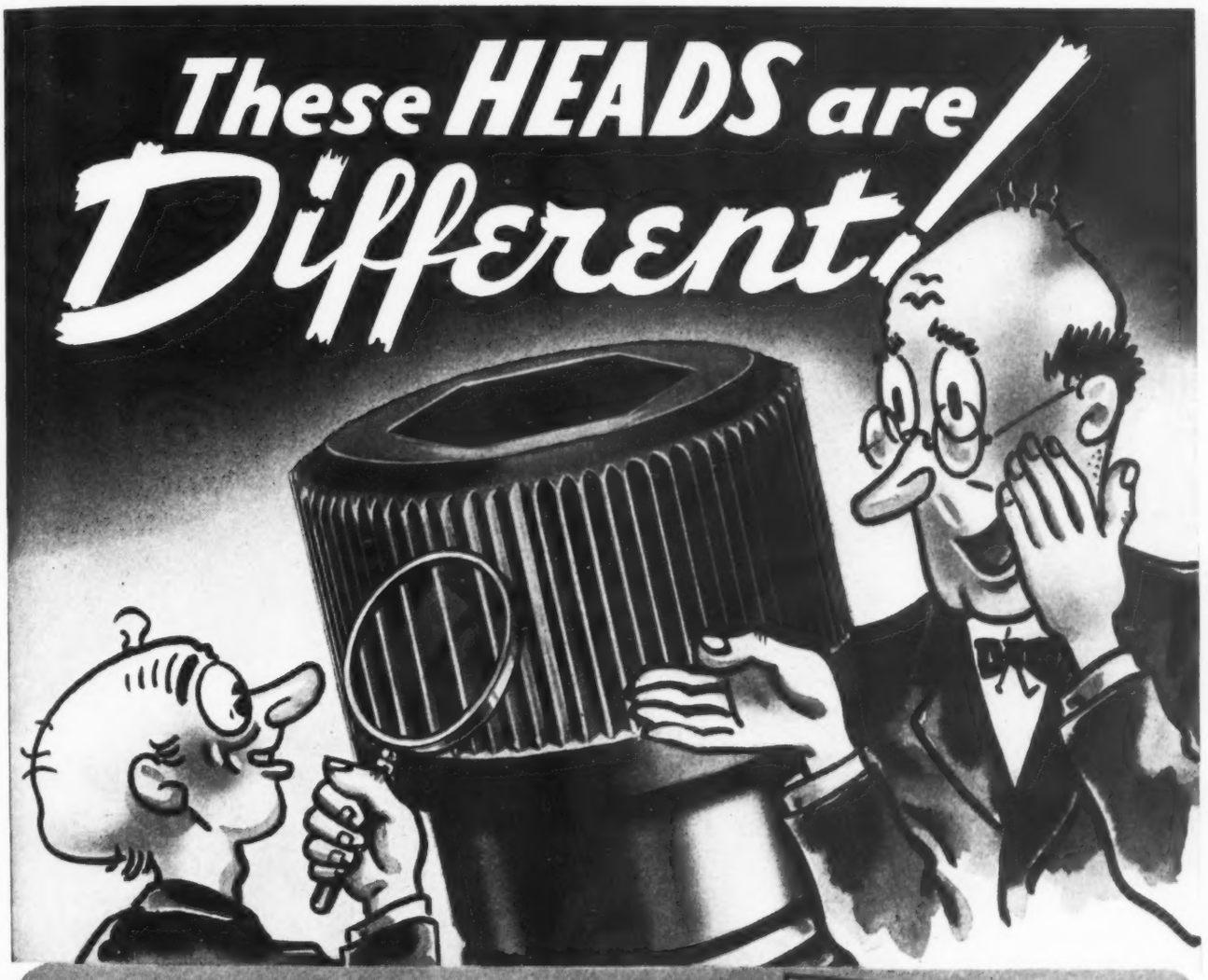
M43-2A

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

MOTORS · TRANSFORMERS · FANS · BRAKES

These HEADS are Different!



knurled **UNBRAKO** Reg. U. S. Pat. Off.

SOCKET HEAD CAP SCREWS

To provide a better grip for mechanics, who generally prefer to run a cap screw down as far as possible with their fingers before applying a wrench, for years we have knurled the heads on "Unbrako" Socket Cap Screws. With the advantage of knurling, fingers won't slip or slide, even though the screws may be oily. Lost time and wasted motion are eliminated. Today, when time is so precious, it pays to make every second count.

This knurled feature costs you no more. Don't fail to get its advantages. Get our catalog for more details.

Sizes from No. 4 to 1 1/2" diameter

Knurling of Socket Screws originated with "UNBRAKO" years ago

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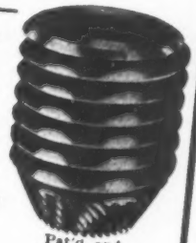
Lick VIBRATION

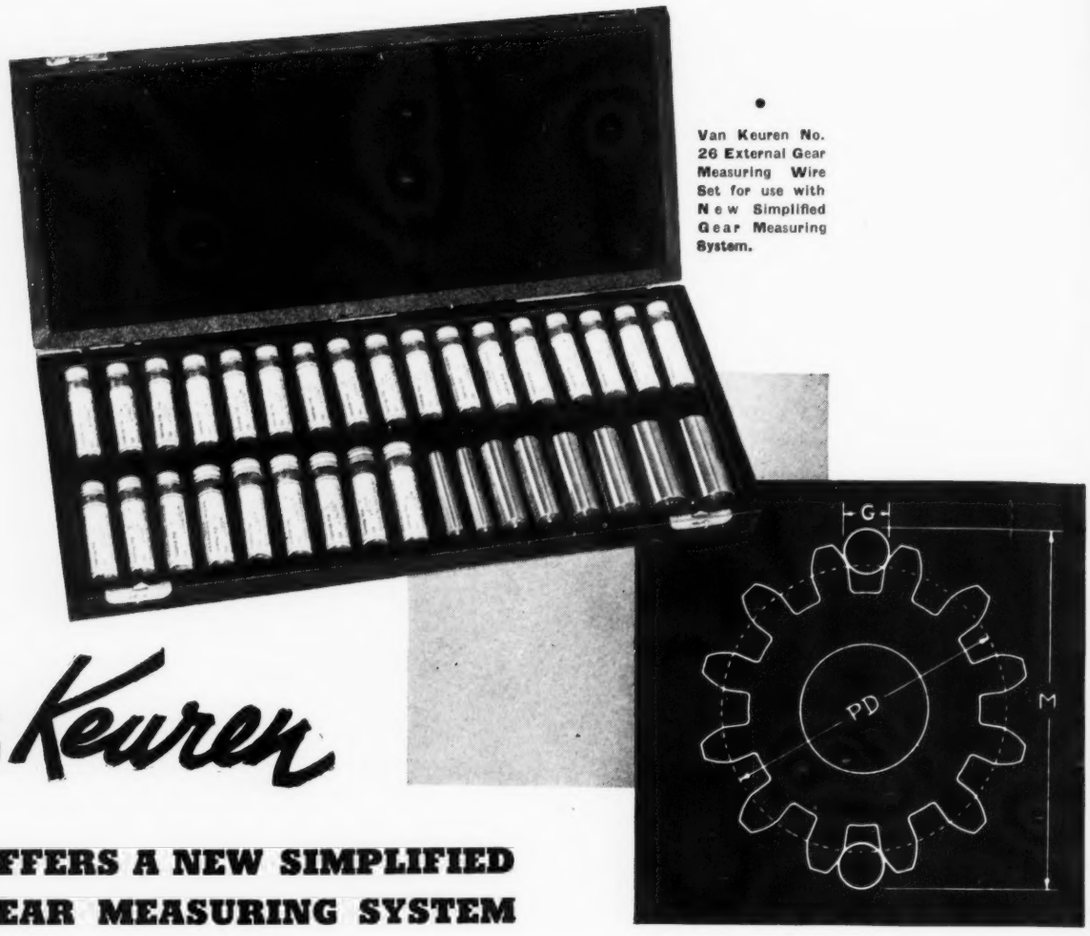
with Set-Screws that won't work loose!

Use "UNBRAKO" Self-Locking **HOLLOW SET SCREWS** *with the Knurled Points*



Pat'd. and Pat's. Pend'g.

Vibrating equipment often causes ordinary set-screws to work loose —endangering valuable machines, possibly holding up vital production. Don't risk this. Replace the plain set screws with "Unbrako" Self Lockers. When tightened as usual, the knurled points on these dig-in and hold the screws tight. However, they're easily backed-out and can be used again and again. Sizes No. 4 to 1½" diameter.



Van Keuren No. 26 External Gear Measuring Wire Set for use with New Simplified Gear Measuring System.

Van Keuren

OFFERS A NEW SIMPLIFIED GEAR MEASURING SYSTEM

Send for Catalog No. 31

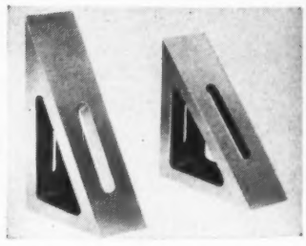
The Van Keuren simplified system for measuring external and internal spur gears with precision wires makes possible more accurate measurements of pitch diameter and tooth thickness. Complete tables are furnished giving the measurement over the wires for 1 diametral pitch. The only calculation required is one of simple division.

The system is based on formulae approved by the American Gear Manufacturers Association. The tables furnished with Van Keuren gear wires are more accurate than any previously available and are complete to 171 tooth gears. Interpolations are eliminated.

Prompt shipment can be made on complete sets of either external or internal gear wires. Single sets (2 wires of a size) for any standard pitch can be delivered from stock.

Van Keuren gear wires are accurate within 25 millionths of an inch for roundness and exact size.

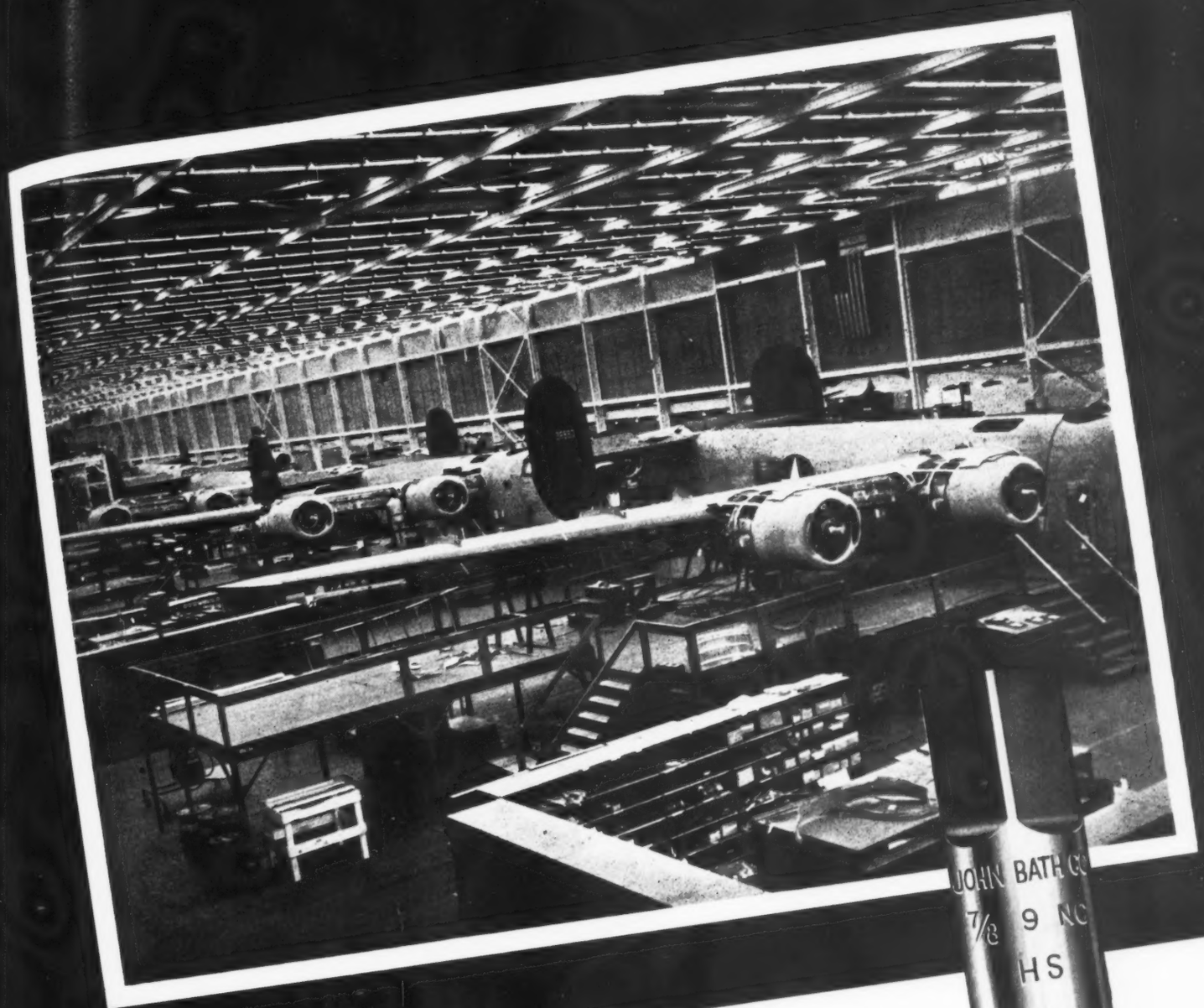
VAN KEUREN 45° and 60° SHOP TRIANGLES SPEED SET UP



Every plant should have at least one 45° and one 60° Van Keuren shop triangle. They are ideal for setup work on surface plates for measuring purposes as well as for use on milling machines, surface grinders and drill presses.

THE Van Keuren COMPANY 176 WALTHAM ST., WATERTOWN, MASS.

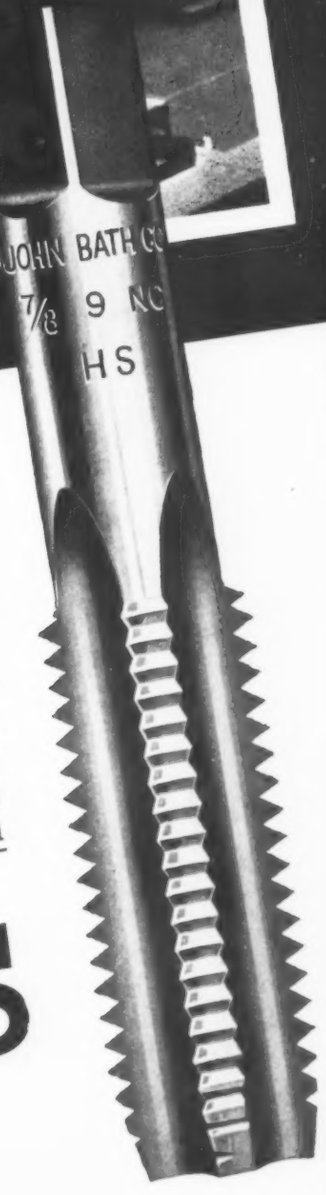
Light Wave Equipment · Light Wave Micrometers · Gage Blocks · Taper Insert Plug Gages · Wire Type Plug Gages · Measuring Wires · Thread Measuring Wires · Gear Measuring System · Shop Trianales



QUALITY
TO *insure* SPEED

Automotive mass-production principles applied to high-quantity Bomber Production include the safeguarding of Accuracy for the sake of speed. In tapping practice, the first step in this direction is to specify BATH TAPS—accurate and fast cutting because they're hardened, toughened, tempered, then ground from the solid! John Bath and Company, Worcester, Mass.

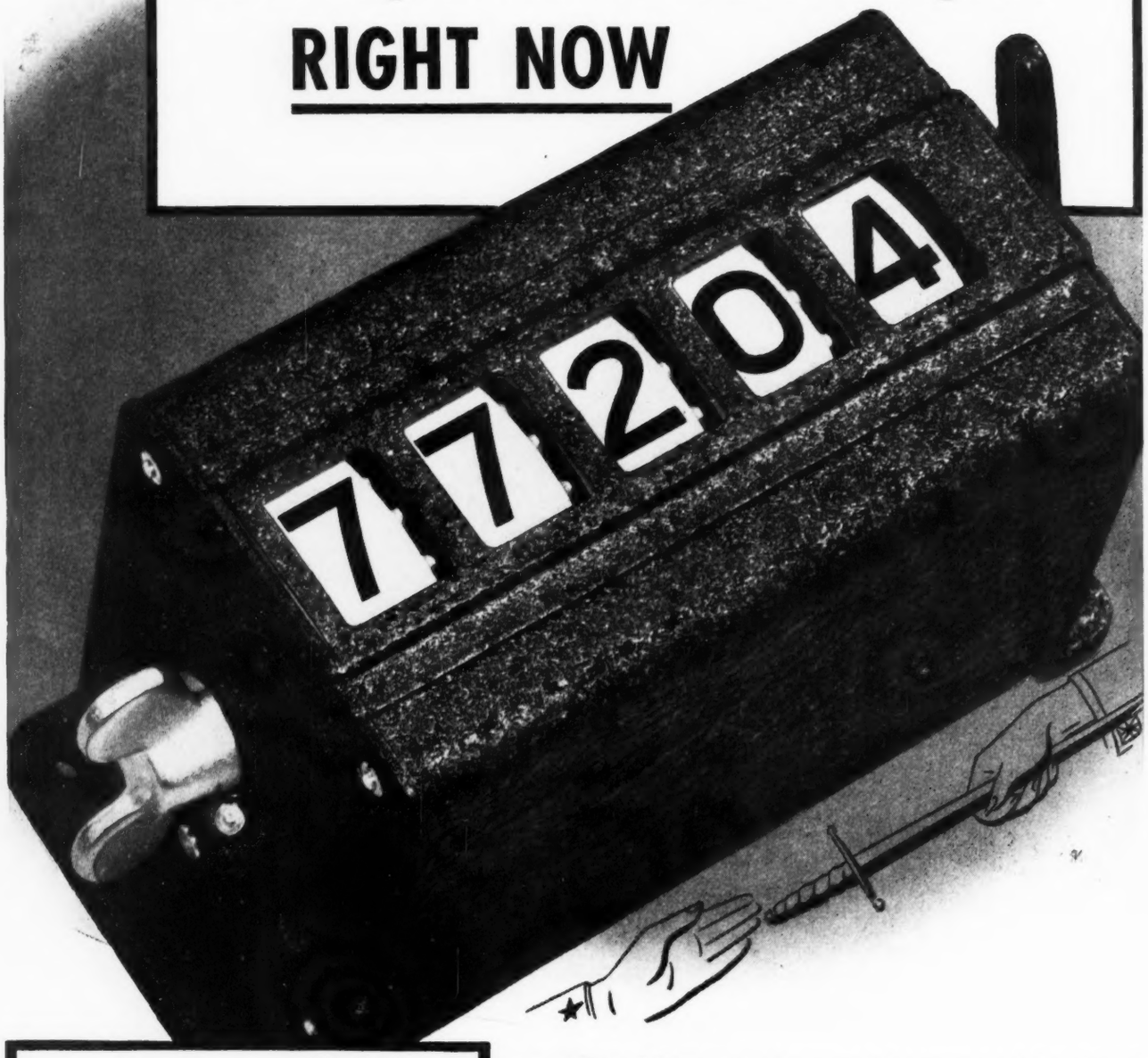
BATH TAPS



PEACE TERMS

are being written in "Facts-in-Figures"

RIGHT NOW



Veeder-Root

INCORPORATED

The Counting House of Industry

The length ~~of the war~~ and terms of the peace are being forecast *today*, in plain black-and-white, by American production machines . . . in hourly and daily facts in figures supplied by Veeder-Root Counting Devices. This accurate "current history" of production eliminates the confusion and uncertainty that cuts down speed and efficiency where no count is kept . . . prevents over-runs and shortages . . . improves interdepartmental co-ordination and timing. All of which is a solid contribution toward one end . . . *a quicker end to this war*. So if your work counts importantly in the War Effort, find out how Veeder-Root can help you make it count to the utmost.

GEOMETRIC

Pointers

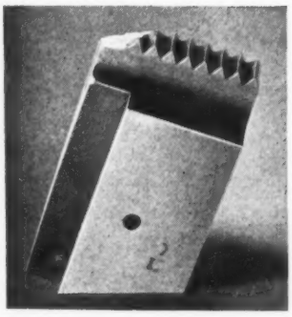
FOR SAVING HIGH SPEED STEEL

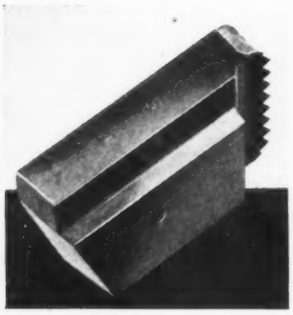
★ ★ ★ ★ ★

No. 2
AVOID SHOULDER THREADING

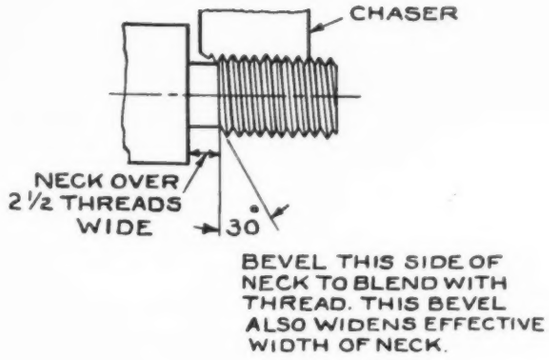
★ ★ ★ ★ ★

Help to save high speed steel! Help to reduce scrap losses by designing your parts to avoid threading close to a shoulder. There are many difficulties in this type of threading, chief among which is the fact that short chamfer chasers must be specially made. In addition, the short chamfer makes it more difficult to produce accurate threads without rethreading. This is especially true in threading stainless steel, chrome nickel and other alloys used in war production. The photograph at left illustrates still another waste of valuable tool steel, caused by the chasers hitting the shoulder and breaking.





These are but a few of the many difficulties created when close-to-shoulder threads are specified, AND THEY ALL HANDICAP THE WAR PRODUCTION PROGRAM. These difficulties can easily be avoided. The drawing below shows one way in which a screw may be designed to permit the use of long chamfer chasers, a method which can be employed even if parts are already in production. Write us for additional suggestions applying to your specific wartime threading jobs. The Geometric Tool Company, New Haven, Conn.


CHASER
NECK OVER 2½ THREADS WIDE
30
BEVEL THIS SIDE OF NECK TO BLEND WITH THREAD. THIS BEVEL ALSO WIDENS EFFECTIVE WIDTH OF NECK.

The Geometric Tool Company is listed on the Treasury Department's Roll of Honor of those companies which contribute at least 10% of their gross payroll for War Bonds. Buy War Bonds each payday! Insure Victory for America now, and financial security for yourself in the future.

GEOMETRIC

SELF-OPENING DIE HEADS
COLLAPSING TAPS
CHASER GRINDING MACHINES

SOLID ADJUSTABLE DIE HEADS
SOLID ADJUSTABLE TAPS
THREADING MACHINES

WE'VE WORKED TOGETHER TO WIN THIS "E"

It's our war, too. We're all proud to be doing the kind of job that merits the "E".

We women in the Detroit Broach plant are going to do our part in adding stars to this flag.

It has been—and will continue to be—our responsibility to make this "E" stand for "Excellence in Engineering", too.

Four Detroit Broach employees—thoroughly typical of the entire organization. They have done their jobs well . . . they have earned the honor to wear the Army-Navy "E". It is the combined efforts of men and women like these that will continue to increase American production . . . that will guarantee our ultimate and complete Victory.

The "E" and the "Bullseye" on our flagstaff! I'm happy to have had the privilege of helping to win both.

DETROIT BROACH COMPANY

20201 Sherwood Avenue
Detroit, Michigan

THE CATERPILLAR PRINCIPLE

APPLIED TO FILING

SEE HOW DoAll File Bands WORK

DoAll OPENS FILE CLINIC

The facilities of our modern File Research Laboratory, skilled metallurgists and mechanical engineers are now offered free to industry.

Send us your file problem, and we'll get busy at once testing for the proper file, best speed, table tilt, coolant, etc. to turn out your Jonah in the quickest, smoothest, most efficient manner.

Below is shown one view of our Laboratory with the very latest type Photomicroscope in the background. This ingenious invention shows in minute detail the grain structure of your material.

Whether it's metal, alloy, composition material or a laminated product—we can tell you how to file it better.

Jobs tackled for other firms in scores of lines during the past decade give us a background of invaluable experience. Let us help you.

oAll Band Files *Have Guts* . .

y stand up to any metal or alloy, regardless of hardness or nsile strength. They operate with a steady, forward stroke t gets your work done in one-fifth the time of jig filing, e-eighth that of hand filing. DoAlls come in a wide riety of sizes, widths and styles, to suit every kind of job.

ND FOR POCKET-SIZE BAND FILING BOOK

oAll Band Saws—Finest made with extra-hardened ving edges. 100 feet to each Strip-out Box. Ask about m today.

THE DOALL COMPANY

1215 Thacker St., Des Plaines, Ill.

l DoAll offices distribute DoAll Files. They also sell and service the machines nd tools shown below. See your Telephone Directory for nearest DoAll office.

ster Gage Blocks

e sets made in following accuracies:

LABORATORY Set, 2 millionths of an inch

INSPECTION Set, 4 millionths of an inch

WORKING Set, 8 millionths of an inch

w for data on good deliveries.

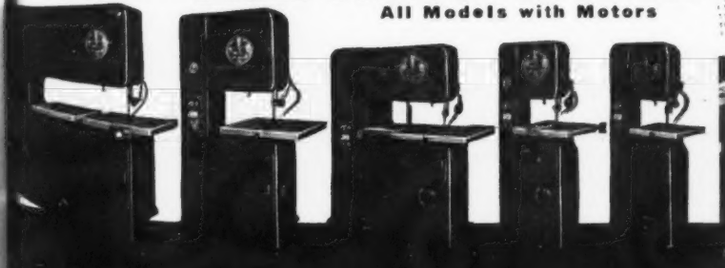
DoAll Surface Grinder

Finest grinder made for those who require high precision accuracy as to size, flatness and parallelism. Adaptable to wet or dry grinding.

Savage Tool Co., Savage, Minn.

HE BIG 5 · · · DOALL CONTOUR MACHINES

All Models with Motors



A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) .. Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) .. Added Height Available on Order	48"	60"	75"	100"
Spindle Diameter	2¾"	2¾"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44"x60"	60"x80"	60"x80"	60"x108"
Overal Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

WICKES UNIVERSAL CRANKSHAFT LATHES

SPEED PRODUCTION OF GAS, DIESEL, AIRPLANE CRANKS

PURPOSE Wickes Universal Crankshaft Lathes are designed for machining main line bearings and crankpins on all sizes and types of crankshafts such as gas engine, automobile, tractor, airplane and Diesel crankshafts. They turn all crankpins and intermediate main bearings, or all main bearings, on a single machine.

HYDRAULIC FEEDS Wickes Crankshaft Lathes are equipped with independent hydraulic feeds to both the carriage and cross slide, which feeds are controlled by drum switches on the front of the carriage. The feeds to carriage consist of Rapid Traverse, Coarse Feed, Intermediate Feed and Fine Feed both right and left. The cross slide is provided with these same feeds in, and rapid return out.

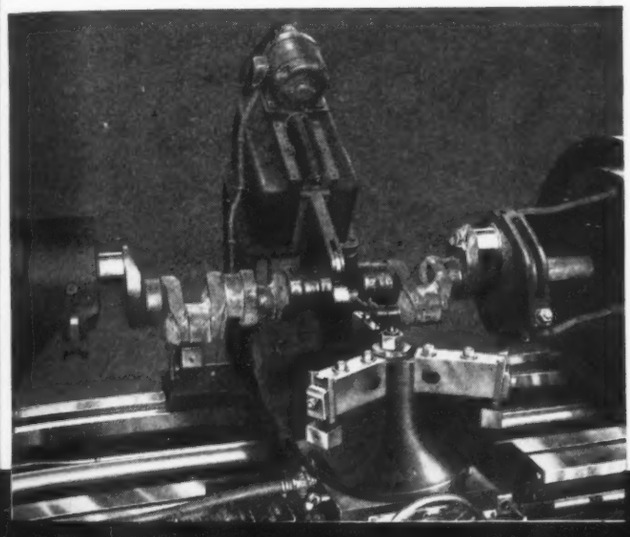
CAPACITIES Wickes Crankshaft Lathes are built in four sizes, 36", 48", 60" and 72". The UH-4 (36") machine is suitable for machining crankshafts having main line bearings and crankpins up to approximately 4" or 4½" in diameter and with strokes up to 7½".

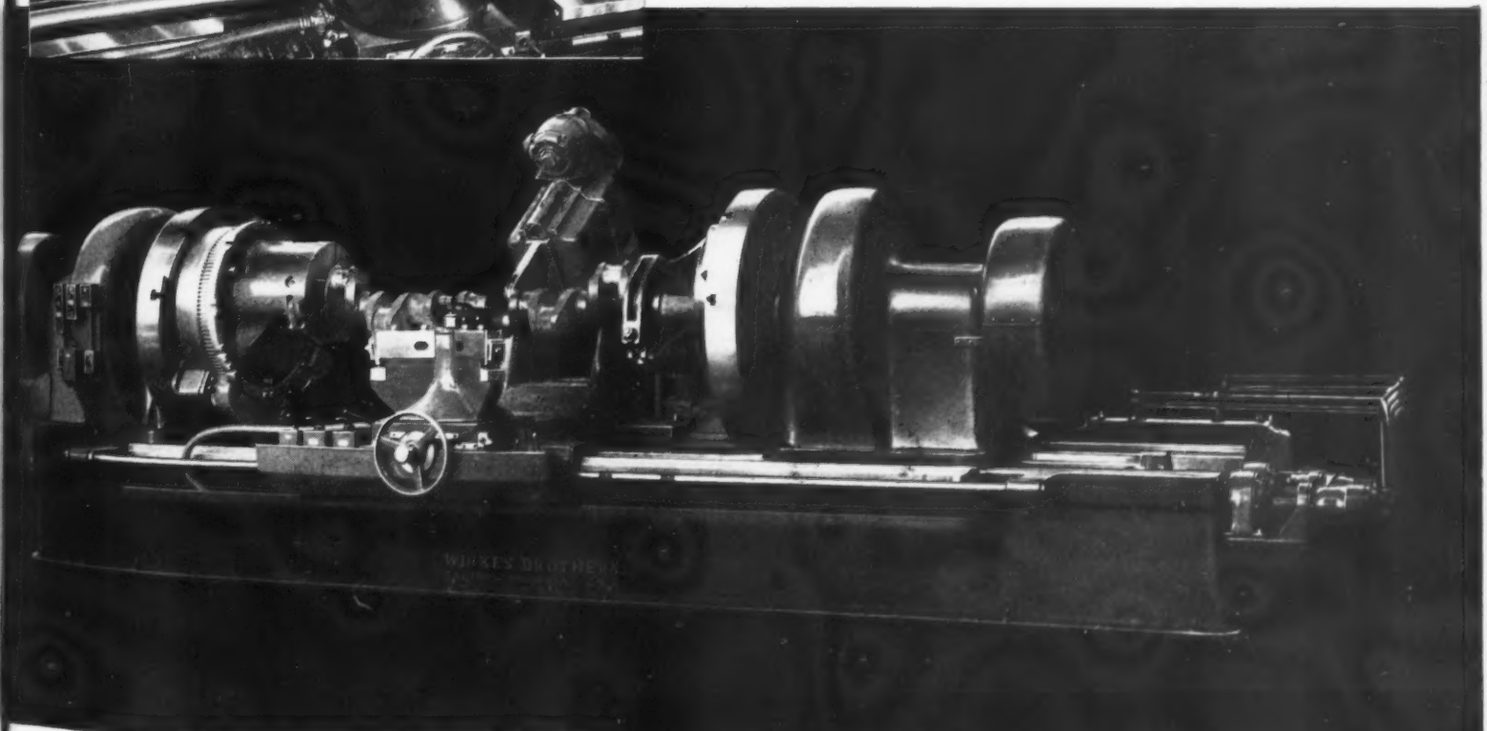
The UH-8 (48") machine is suitable for machining crankshafts having main journals and crankpins up to 6" in diameter and with strokes up to 10".

The UH-60 (60") machine is designed for machining cranks having main bearings and crankpins up to approximately 10" in diameter and with strokes to 14".

All sizes are built with either double end drive or single end drive. The double end drive models machine the intermediate main line bearings and crankpins. The single end drive models machine the main line bearings and the two ends of the crank.

To get into real high-speed production on your crankshafts, it will pay you to operate one of these Wickes Lathes designed expressly for the job. Write today for illustrated Bulletin U-801.





A Wickes Model UH-8 (48") Universal Crankshaft Lathe, double end drive type. Inset (above) shows back roller rest in position for supporting a long crankshaft while machining intermediate crankpin.

WICKES BROTHERS SAGINAW, MICHIGAN · EST. 1854

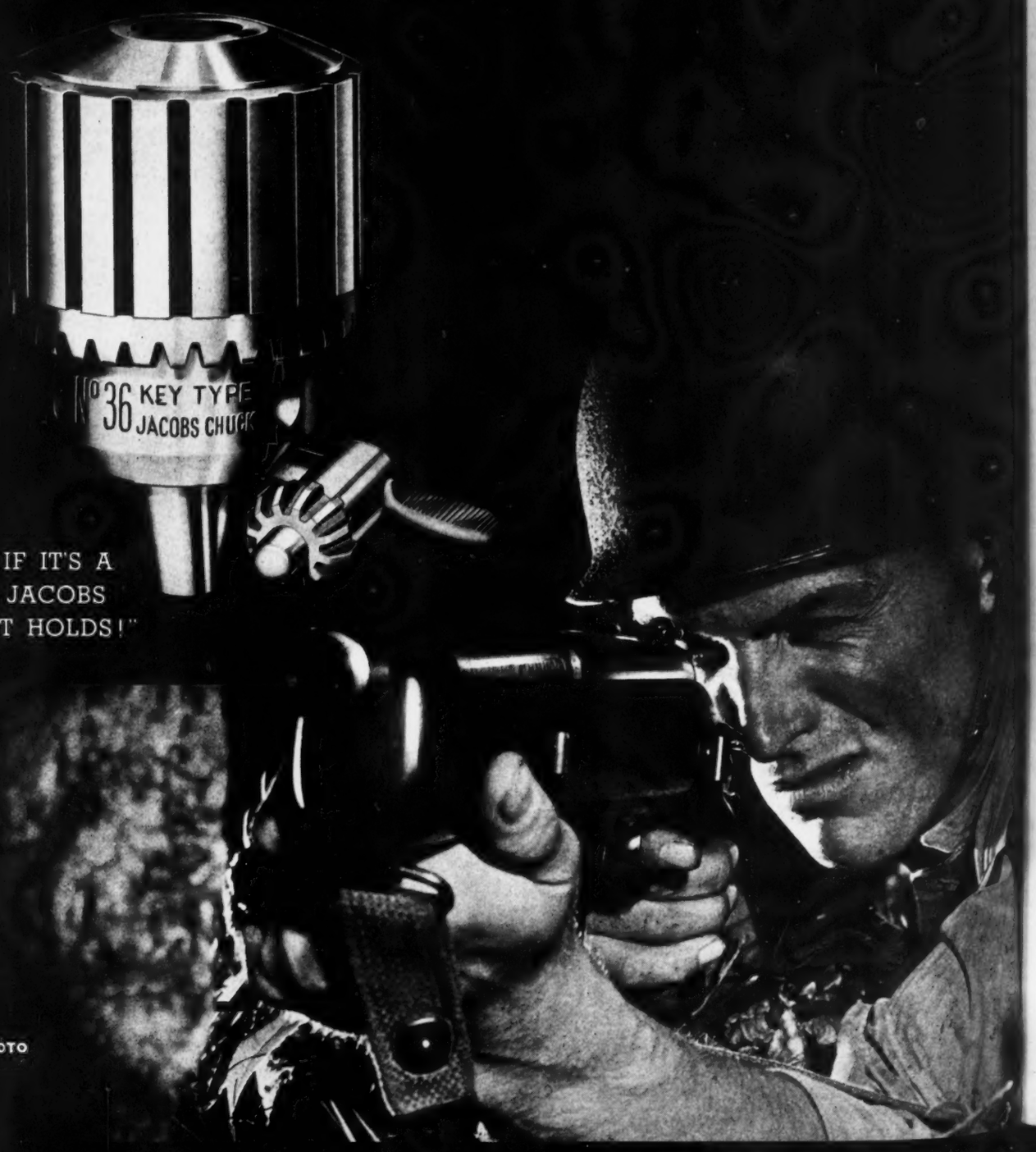
Crankshaft Turning Equipment · Double End Boring Lathes · Heavy Duty Engine Lathes · Special Production Lathes · Blue Print Machines

JACOBS

Confidence in Jacobs Chucks is justified by exclusive designs for maximum strength, closer accuracies, powerful grip and long wear. Their unfailing performances assure speed on the production fronts, victory on the battle fronts! The Jacobs Manufacturing Co., Hartford, Conn.

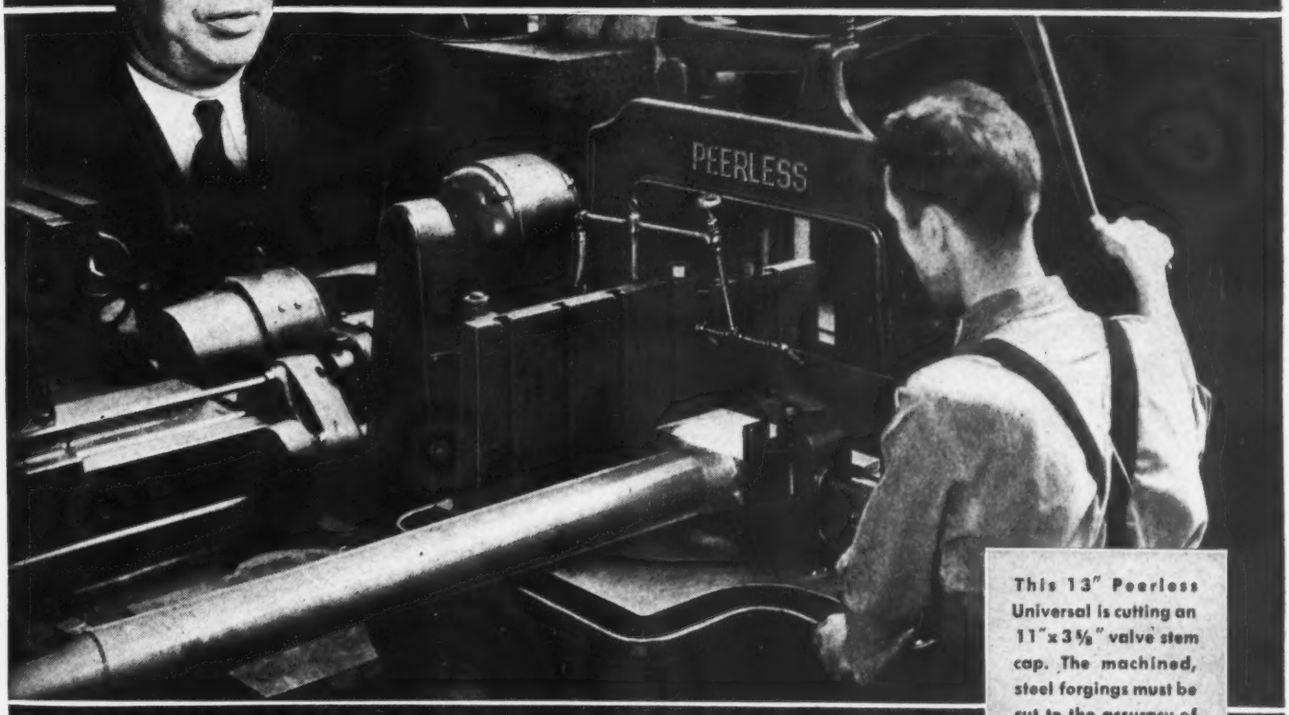
THE NATIONAL STANDARD
FOR WAR PRODUCTION

"IF IT'S A
JACOBS
IT HOLDS!"



O.W.I. PHOTO

"A PEERLESS CUTS THE VALVE STEMS"



This 13" Peerless Universal is cutting an 11"x3⅛" valve stem cap. The machined, steel forgings must be cut to the accuracy of thousandths. 2500 sq. in. are cut with a single high-speed-steel blade.

IT SAWS ACCURATELY . . . FAST AND SAFELY!

CUTTING the valve stems for the huge steam engines which give our battleships the speed to out-maneuver the enemy, is an assignment that demands Peerless accuracy. When it's a Sawing job — where accuracy is the number one requirement, Peerless invariably get the call. Peerless is the only Saw that has the Four-Sided Saw-Frame and Backing-Plate Blade-Support.

FAST cutting is made more practical, too. Blade life is lengthened. And the thin, cool-running, straight-cutting blade affords maximum SAFETY for men and metal. If the blade grows dull and breaks, due to neglect, the Peerless stops automatically, preventing the slightest off-square cutting. Only a Peerless can give you the advantages of the patented Four-Sided Saw-Frame.

The few minutes required to mail the coupon may produce the answer to one of your war winning problems.

PEERLESS MACHINE COMPANY
1600 JUNCTION AVENUE • RACINE, WISCONSIN

PEERLESS MACHINE COMPANY, Dept. M-243, Racine, Wis.
Mail cutting time estimate for.....

☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

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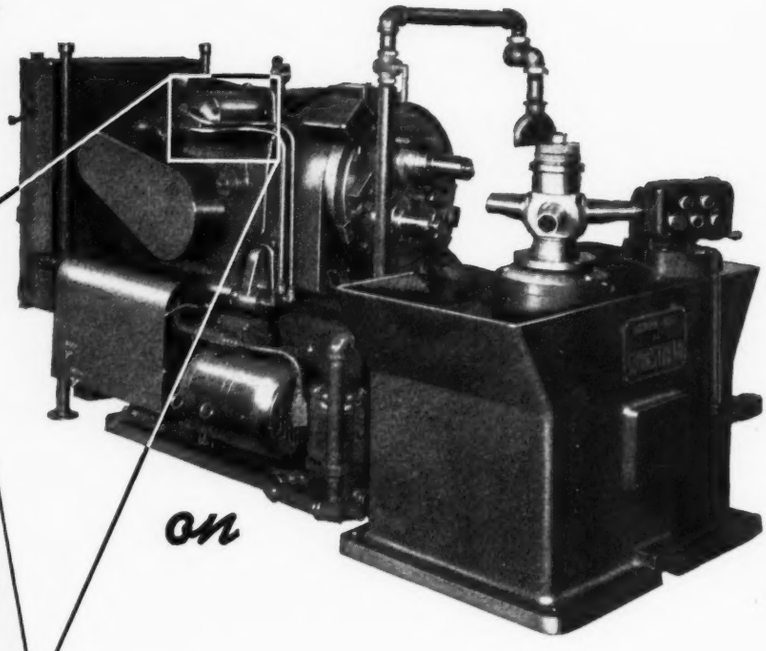
Peerless POWER SAWS

• *Fast* ACCURATE *Sawing* DEMANDS POSITIVE BLADE CONTROL •

RBC NEEDLE BEARINGS

help speed war production



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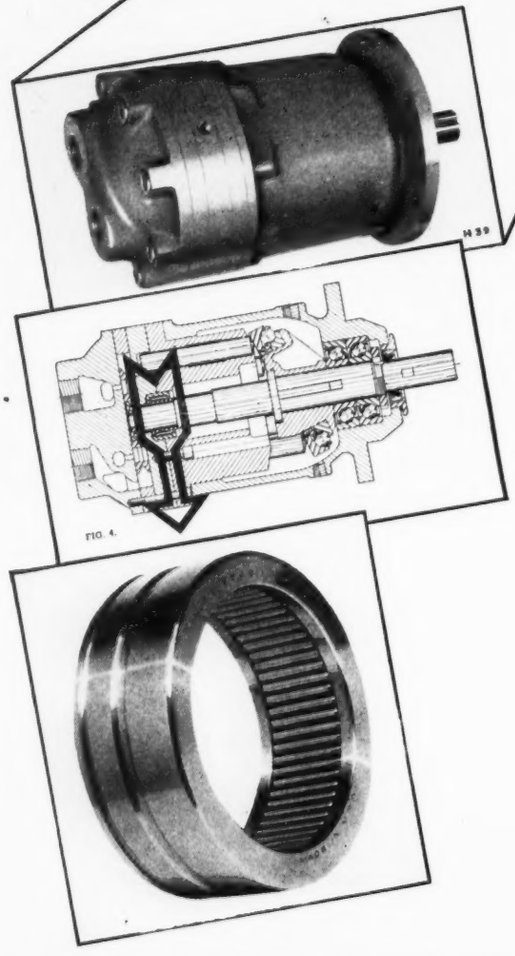


SUNDSTRAND Hydraulic Units

Milling the curved surfaces of airplane propeller hub spiders is speeded up by the use of a Sundstrand Fluid Motor which rotates the head on the milling machine shown above. Sundstrand says in part, "All of the parts (of the motor) are designed for precision manufacture to exceedingly close limits. Friction between moving parts is negligible . . . "

Here then is a logical application for RBC CYCLOPS Bearings, anti-friction type carrying heavy radial loads and occupying minimum space. It is a self-contained bearing with a one piece through hardened and ground outer race encasing a full complement of rollers. An oil groove in the race eliminates the necessity of grooving the housing while a snap ring channel makes it easy to locate and secure the bearing in the housing.

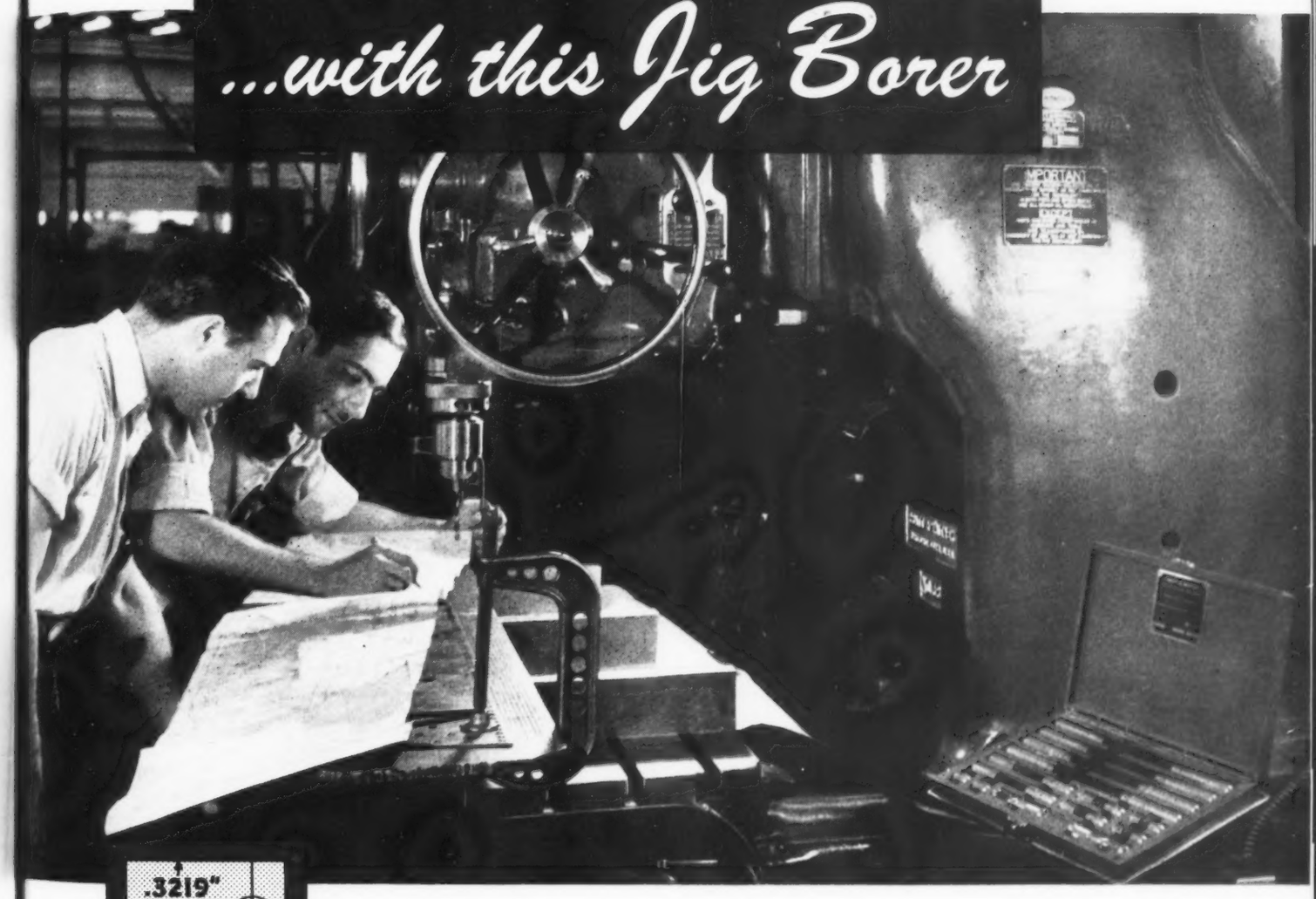
On any problem affecting the application of roller bearings to any type of machinery or industrial equipment, call on RBC engineers.

ROLLER BEARING CO. of AMERICA

TRENTON . . . . NEW JERSEY

You could bore at any one of 100 million points in a square inch

...with this Jig Borer



TO make sure you have available all the precision you *do* want, Pratt & Whitney builds into this jig borer a degree of accuracy you'll probably seldom need.

Let's say you're making a jig, and want to bore a hole at a known point. With the P&W Jig Borer, you *could* work to *four decimal places* . . . take your choice of 100 million points in any square inch . . . not just on paper, but *right in the cold metal itself* . . . if you control such variables as temperature and tool wear.

The P&W Jig Borer is one of many Pratt & Whitney products that provide *basic accuracy for mass production*. It can split the linear inch into 10,000 equal parts. It locates, bores, and then checks its own work. From the operator's standpoint, the most important guarantee of accuracy is the pair of dial indicators; once zeroed to a given position, these show at a glance any change from original setting . . . at any stage of the job. Results: speed, precision, less spoilage.

You may seldom work to the last "tenth." But for sure, dependable *basic accuracy* under all working conditions you'll be wise to invest in this *real* jig borer that imposes no limit on your precision.

Call on Pratt & Whitney. Details of P&W Jig Borers will be supplied on request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

CONVERT down time TO *productive time*

Look at your cutting-off operations! Imagine the production you could be getting if so much time weren't lost in resetting tools after re-sharpening. Wherever Empire Tool Company's Luers Patented Cutting-off Tool Holders and blades are in use, the reduction in down time has effected extremely high production gains.

Note these outstanding features

ACCESSIBILITY—Simple release of double cams permit blade to be easily removed from holder from side, back or front. Holder retains original setup and is never removed from machine. Ground slot permits instant re-alignment of blade after sharpening.

DURABILITY—Luers Holders are made of finest nickel steel, double treated to give Rockwell case with an extremely tough core. Cams are made of chrome nickel.

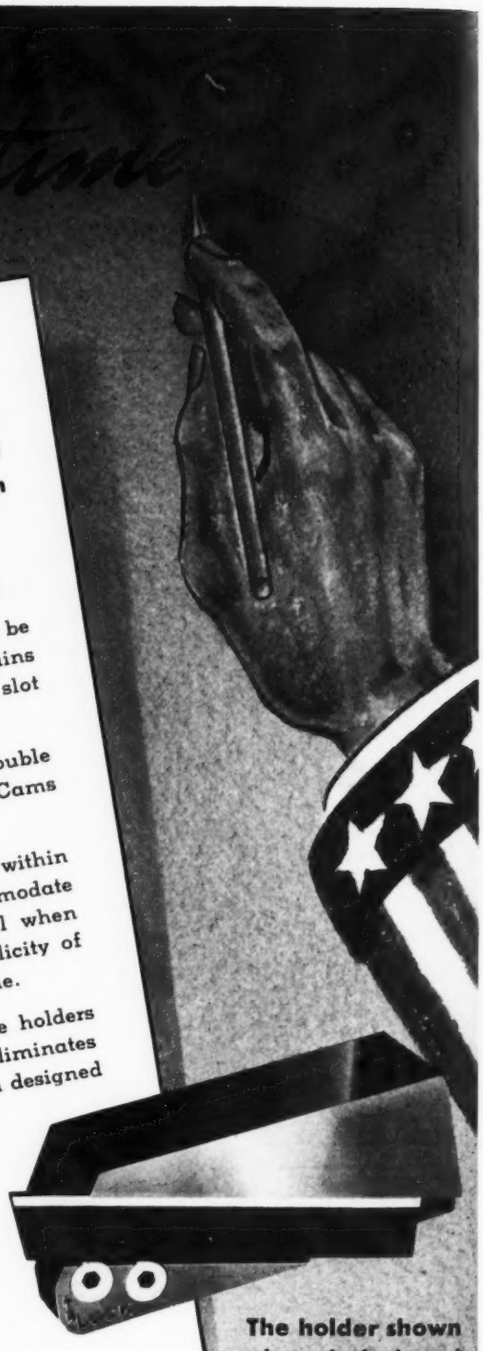
ECONOMY—Design of holders permits blades to be used within one inch of their original length. Each holder will accommodate two different thicknesses of blades—a saving in material when small diameter bars are used on larger machines. Simplicity of blade removal, without destroying setup reduces down time.

EFFICIENCY—Blades produce free cutting action because holders are provided with proper top clearance or rake, which eliminates hand grinding of lip on top of blade. Holders have been designed with maximum rake.

RIGIDITY—Two developed cams on the under side of blade force top edge of blade against ground slot. Chatter and vibration are thus eliminated, and possibility of blade fracture is reduced.

SIMPLICITY—Entire line of Luers Patented Cutting-off Tool Holders has been designed and built to be adaptable to the individual machine without alterations to either machine or tools.

LUERS PATENTED CUTTING-OFF BLADES AND HOLDERS ARE PRODUCED BY EMPIRE TOOL COMPANY UNDER LICENSE ISSUED BY JOHN MILTON LUERS PATENTS, INC.



BUY WAR BONDS

Special holders designed for each of the following machines:

Acme Gridley
Brown & Sharpe
Cleveland B Vertical
Cone Automatic
Davenport
Greenlee Automatics
Gridley Automatics
National Acme
New Britain Automatic

The holder shown above is designed for:

Bardons & Oliver
Foster
Gisholt
Libby
Midland
Millholland
Morey
Simmons
South Bend
Warner & Swasey
And all other machines employing open side tool posts

Send for new catalog

EMPIRE Tool Co.

8786 GRINNELL AVE., DETROIT, MICH.

BRONZE BEARING SERVICE GEARED TO WAR NEEDS

● Bunting Bronze Bearing Service provides the speed, efficiency and quality of product that meet war-time requirements for machinery production and maintenance. Ready-for-assembly Bunting Bronze Bearings for machine tools, electric motors and all kinds of industrial equipment are available from stocks maintained in all principal cities. Factory-finished Bunting Bearing Bronze Bars in hundreds of sizes save metal, time, labor, tools in machining operations. Ask your wholesaler. Write for catalog. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

Bunting

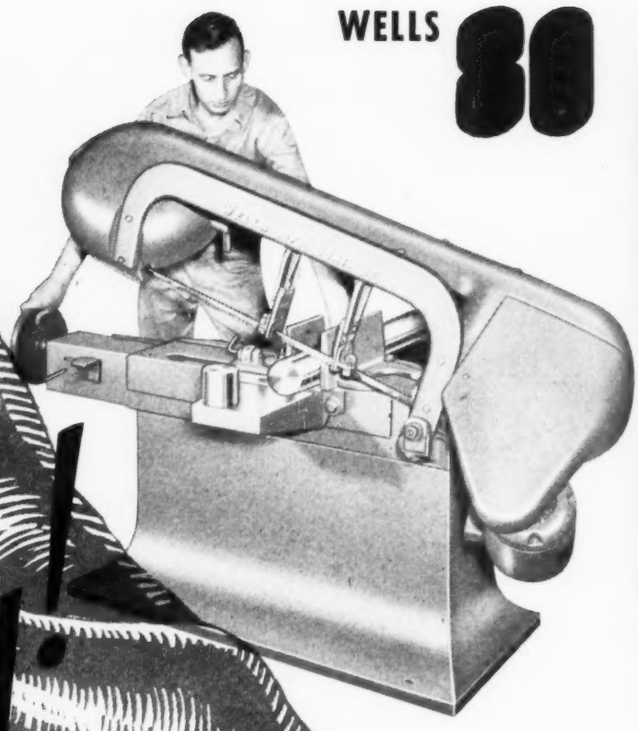
BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

WARTIME PEACETIME

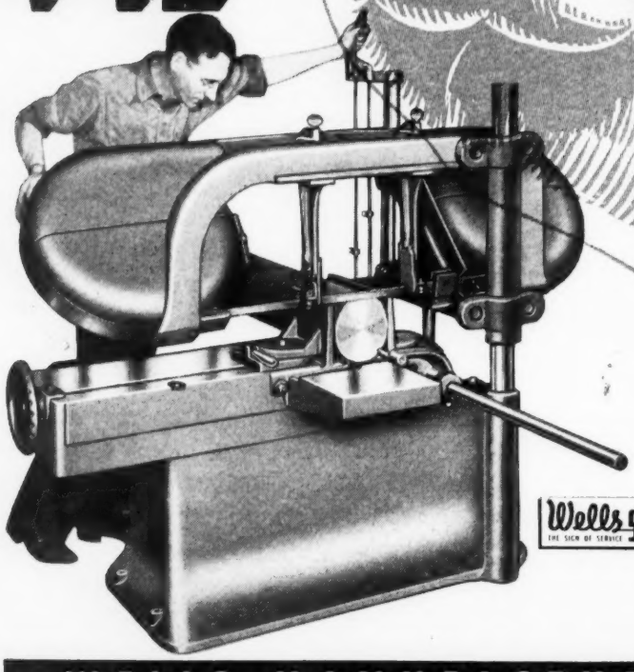
KEEP 'EM CUTTING . . .

The Wells Way!

WELLS **80**



V-12



Choose a Wells and you will have a saw that is not only equal to the demands of war production but a tool that will help you solve your metal cutting problems in peace time competition — for years to come. Their long experience in saw design and manufacture has enabled Wells engineers to build the greatest durability and cutting efficiency into the New Model 80 and V-12.

Tested and proved on tough cutting jobs like tool steel and castings of all types and shapes, they are ready to do your metal cutting with speed and accuracy — for the duration and many years after.

Phone your Mill Supply dealer or write direct.

Wells Has Established Leadership

Wells SAWS
THE SIGN OF SERVICE

SPECIFICATIONS

SERIES 80 METAL SAW

Capacity: Rectangle	8" x 16"
(spec. bowed guides)	5" x 24"
Rounds	8" dia.
Speeds: ft. per min.	60, 90, 130
Motor	Specifications optional

V-12 METAL SAW

Capacity: Rectangle	13" x 16"
Round	13" dia.
Speeds: ft. per min.	50, 90, 150
Guides	Adjustable
Feed	Hydraulic-Controlled
Vise	New quick acting type
Motor	Specifications optional

A large stock of blades is available at all times

WELLS MANUFACTURING CORPORATION

METAL CUTTING BAND SAWS

404 SOUTH GRANT • THREE RIVERS, MICHIGAN

NO. 2 MACHINE WITH BACK GEAR

8" or 12" Overhang • 5/8" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 R.P.M. • 280 to 3450 R.P.M. • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

Full Range Drilling
FOR HIGHEST PRODUCTION

✱ The choice of fine machine tools now will help you meet those new production schedules needed to win the war.

Footburt sensitives are built with the wide range of speeds and with the power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period. • *Write, wire or phone for prices and delivery information.*

THE FOOTE-BURT COMPANY, Cleveland, Ohio
Detroit Office: General Motors Building

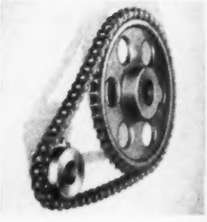
FOOTBURT *Sensitive* DRILLING MACHINES

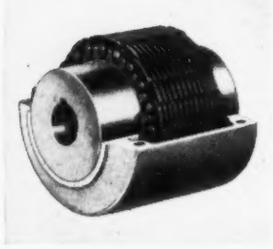
AN IMPORTANT ADVANTAGE IN PLANNING POWER DRIVES

MORSE Makes Both . . . SILENT and ROLLER CHAIN DRIVES

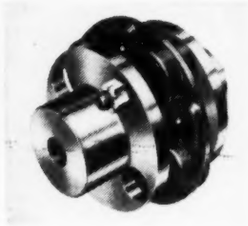
Morse Silent Chain Drives operate at practically 100% efficiency, year after year. Quiet and smooth in operation, they insure maximum machine output. The Morse principle of "Teeth, Not Tension," means no slip—no wasted power. Wide range of chain capacities.

Morse Roller Chain Drives are equipped with effective "oil feed" system in every link. This exclusive design gets oil to the heart of chain. Oil gets in, wear stays out! They last longer, require less maintenance. Interchangeable and available in single and multiple widths.

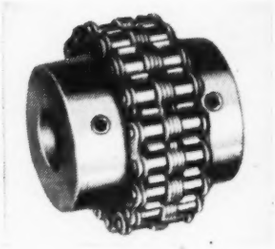




Morse Silent Chain Couplings compensate for shaft misalignment. This simple and rugged coupling consists of two facing steel sprockets wrapped with Morse Silent Chain—enclosed in a machined split case. Links acting on sprocket teeth form flexing medium. They are easily installed and available in many sizes.



Morse Morflex Couplings contain two steel hub members and a floating center unit assembly to which each hub is separately connected through resilient rubber trunnion blocks. There is no metal on metal movement. Rubber allows for maximum distortion without loss of efficiency. Cuts maintenance cost.



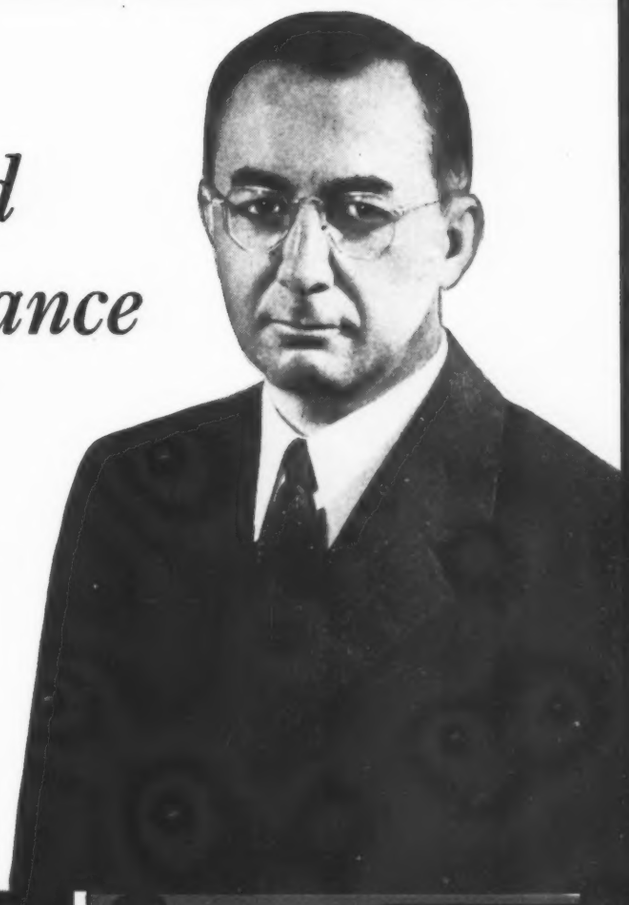
Morse Roller Chain Couplings embody many outstanding features that make for unusual flexibility and long-life. Highly compact, they consist of two facing sprockets wrapped with Morse Roller Chain. Easy to install and align. Wide range of stock and special sizes—covers if desired. Send for coupling data today.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

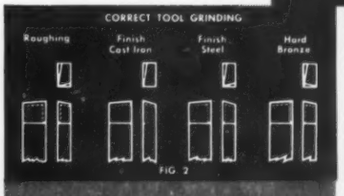
"Correct cutting speed is of the utmost importance in metal turning"



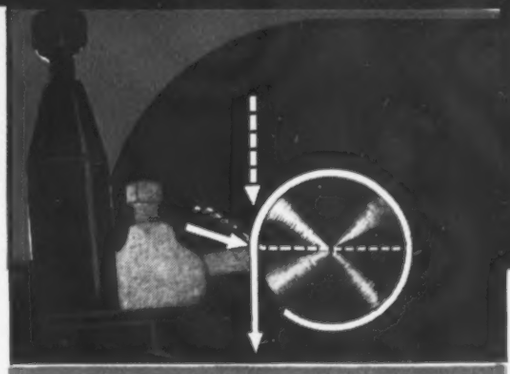
says GEORGE M. CLASS
Vice-President in Charge of Engineering
GISHOLT MACHINE COMPANY
Madison, Wisconsin

Latest Gisholt contribution to the war effort is the new Heavy-Duty Turret Lathe with time-saving Gisholt Speed Selector, which is helping American industry "MAKE IT FIT TO FIGHT."

"SELECTING THE PROPER TOOL to cut a specific kind of material is only part of a cutting operation. For the best results the machine should be operated at correct cutting speed. To select this speed properly, it should be kept in mind that the faster the rate of the cutting speed, the closer you approach the speed at which the cutting tool actually *cuts* the metal and does not just push it off the part being machined.



"TO ACHIEVE the desired clean cut, the tool used should be ground at regular intervals (Fig. 2 above). A good rule to follow is: the cutting speed for roughing tools should be maintained at a rate resulting in approximately a 4-hour tool life between grinds; with a tool life of from 8 to 12 hours between grinds for finishing tools.



"IT IS ALSO TRUE that the faster the cutting speed the better the finish on the work. For at the point of speed where the tool actually cuts the metal, in place of pushing it off, a very smooth finish will be produced. Always run as fast as the tools and the design of the work will permit.

"IT IS ALSO DESIRABLE to use a cutting lubricant that not only will keep the work and tool cool, but also will lubricate the cutting edge of the tool. This allows the chip to slide more freely over the top of the tool, thus producing a better cutting action and allowing an increase in cutting speed."

The correct cutting oil is as important to proper machine tool operation as the correct cutting speed. That's why Shell has developed a control technique that "balances" the oil to the machine, the application and the tool. Call in the Shell man now for details.

SHELL

SHELL LATA OILS
FOR METAL WORKING

A 100-page Blueprint .

Wartime Conservation

RECOMMENDATIONS FOR EFFECTING IMMEDIATE SAVINGS OF CRITICAL MATERIALS IN THE APPLICATION AND USE OF WESTINGHOUSE EQUIPMENT . . AND AT THE SAME TIME GETTING MORE PRODUCTION OUT OF PRESENT EQUIPMENT

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH

THIS BOOK CONTAINS DEFINITE RECOMMENDATIONS...

From generator to motor . . . Critical Material savings in selection, application and use of electrical equipment.

On the production line . . . New methods of speeding production made possible by Westinghouse developments.

Keep 'em running! Maintenance and repair service as an aid to production.

Replacement—not substitution . . . Micarta and Prestite are superior to the Critical Materials which they replace.

All in the day's work . . . How Westinghouse is saving Critical Materials in its own manufacturing operations . . . including complete plans for a systematic industrial scrap salvage campaign.

to help you plan your Conservation Strategy

We no longer are "too rich" to worry—the Axis has more Critical Materials than we do.

To help America save Critical Materials . . . to assist industry in planning its conservation strategy, Westinghouse has published an authoritative 100-page book. It contains recommendations for effecting immediate savings of Critical Materials in the selection, application and use of electrical equipment . . . and at the same time getting more production from present equipment.

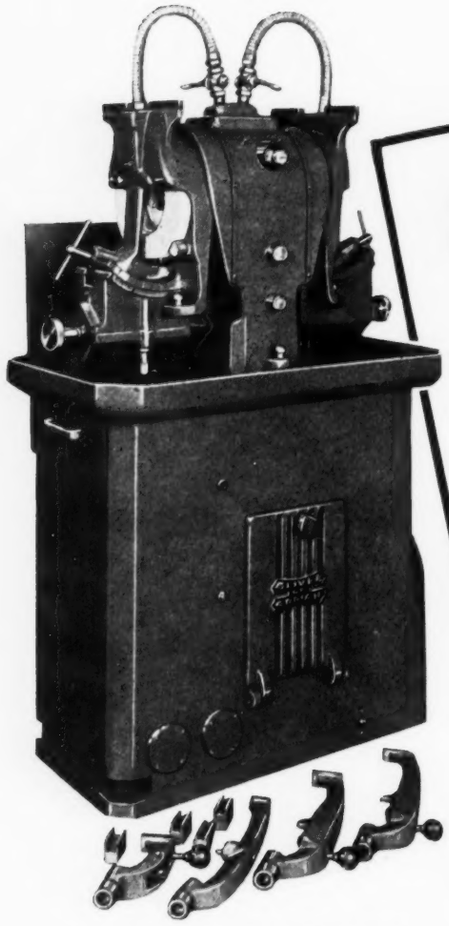
Write for your copy today (company letterheads, please!). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-90460

Comparison of United Nations and Axis resources prior to war and today

	Before the war		*Now*	
	United Nations	*Axis*	*U. Nations*	*Axis*
STEEL	73%	27%	50%	50%
COPPER	94%	6%	83%	17%
TIN	99+%	1–%	35%	65%
ALUMINUM	68%	32%	42%	58%
PIG IRON	75%	25%	44%	56%
TUNGSTEN	95%	5%	65%	35%
MAGNESIUM	44%	56%	32%	68%

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE



ACCURATE UNIFORM SINGLE POINT TOOL GRINDING

THE OLIVER TEMPLATE TOOL BIT GRINDER

Machine performance can be no better than the tools that do the cutting! Keep your single point cutting tools in condition for maximum war production efficiency with the Oliver Template Tool Bit Grinder. Using a master template, this Oliver Grinder produces correct top rake, accurate clearances and sharp cutting edges, assuring uniform results entirely independent of the skill of the operator. Heavy, rigid and vibrationless, it can grind carbide and other high speed tools rapidly and accurately.

No single factor is more important in maintaining the efficiency of a machine than the keenness of its cutting tools. Keep them uniformly accurate and free cutting and they'll be able to handle today's high pressure war production with economy, speed and accuracy. Used extensively in the Aircraft industry on special tooling for Propeller production. Also by many Cutting tool manufacturers.

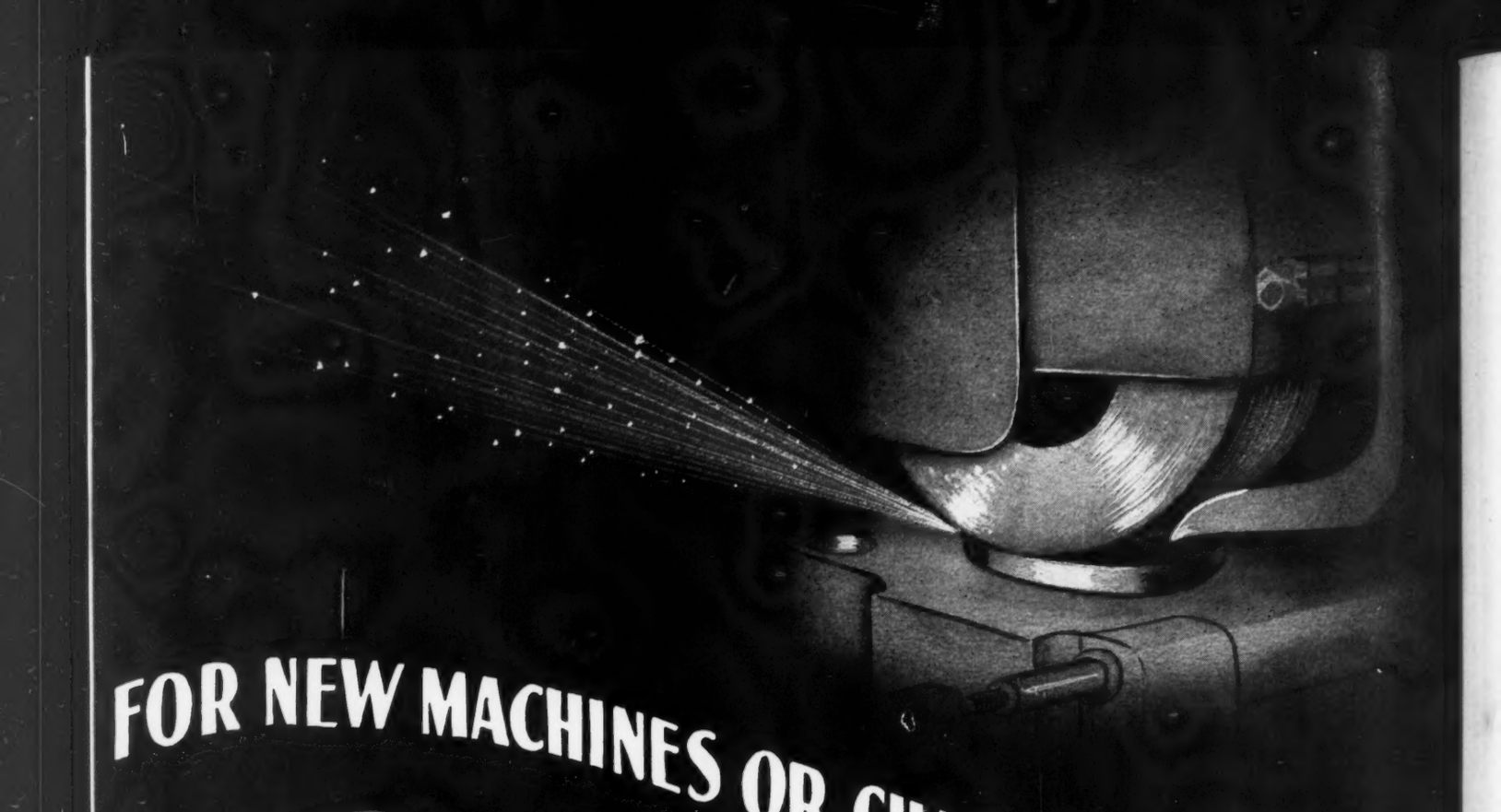
Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1410 E. Maumee St. Adrian, Mich.

Oliver
OF ADRIAN

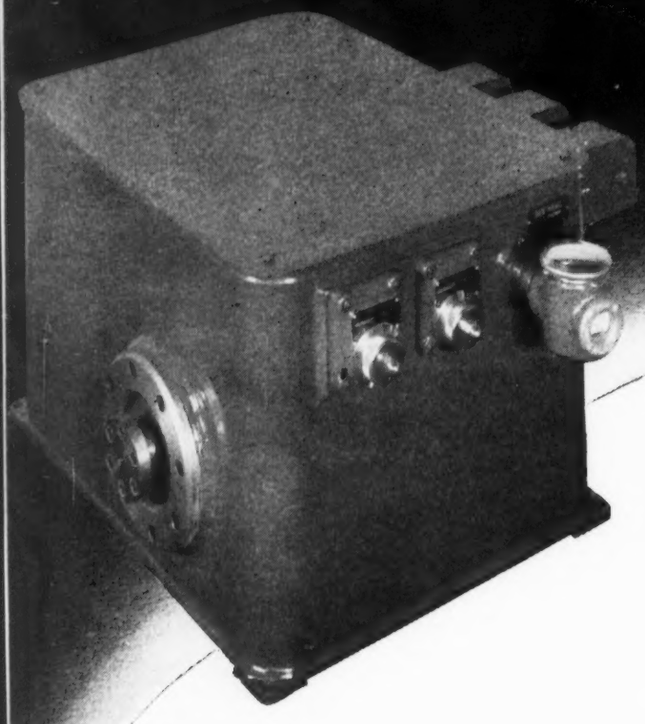
AUTOMATIC DRILL GRINDERS — TOOL AND CUTTER GRINDERS — DRILL POINT THINNERS — TEMPLATE TOOL GRINDERS — FACE MILL GRINDERS — DIEMAKING MACHINES

SLOCOMB
ON GUARD!
Guarding the precision of all types of war essentials, from giant four-motored bombers to delicate instruments, Slocomb Micrometers are in daily use—hard use!—in hundreds of war production plants. Sizes and types for accurate measurements from .0001 to 60 inches all have exclusive Slocomb features, including the Slocomb all tool steel screw. This screw, with four times the bearing surface of other micrometers, insures longer-lasting accuracy under the severest conditions of constant use.
J. T. SLOCOMB COMPANY
PROVIDENCE, R. I.
New York Chicago Cleveland
Detroit San Francisco Los Angeles
Seattle Denver Syracuse



FOR NEW MACHINES OR CHANGE-OVER TO...

HYDRAULICS



The power unit illustrated controls six cylinders on a special contour milling machine—four of which are rapid traverse feed and return . . . two are for clamping. The unit provides a complete automatic machine cycle controlled by push buttons and limit switches, which in turn actuate solenoid operated valves. Feed rates are infinitely adjustable throughout the range of the feed control valves.

There are "HY-MAC" Hydraulic Power Units that may be applied to grinding, milling, boring, drilling, piercing, riveting, pressing, etc. . . . it is merely necessary to establish the functions of the machine that are to be hydraulically operated—and our engineers will recommend a Power Unit and a layout of the circuits to best do the job . . . Hydraulics are completely adaptable to any motion desired—for feed and traverse of multiple or single tools . . . for indexing and locating . . . for clamping, etc., all or any of the movements and in any combination. . . . Any designer or builder of machines can adapt their specific design, either partially or completely to "HY-MAC" HYDRAULICS . . . . . .

Our engineers will be glad to make recommendation and preliminary proposal without obligation.

HYDRAULIC MACHINERY, INC.
12825 Ford Road • Dearborn, Michigan

HYDRAULIC MACHINERY

BOUT of the O'TOOLS...TIME OUT FOR AXIS KNOCKOUTS

Want to oil the skid for the Axis?

MOST important of the pointers on the care of AIR Grinders and Drills is: *Watch your lubrication!* By frequent and regular use of the proper oil and grease, you can oil the skid for the Axis these ways:

1. You get greater production from the tools.
2. You minimize tool maintenance costs.
3. You increase tool life, saving critical materials vital to the war effort.

All the facts on the oiling and greasing of AIR grinders and drills are given on Pages 3, 4 of our booklet, "Keep 'em Running". This complete tool maintenance guide gives practical tips applying to all makes of tools. Salient points also are given on a handy wall chart. A similar conservation plan is available for HIGH-CYCLE tools. State your wishes. No obligation.

Did you know this about AIR tool lubrication?

Special pneumatic tool oils should be used regularly.

Air line lubricator should be used for small tools without reservoir.

Oil reservoir of tools should be filled once each shift.

Lubrication adjustment can be checked from time to time by holding paper over tool exhaust.

Bearings should be washed and repacked with good, light grease every 2 or 3 months of one-shift operation.

These and other pointers are explained in the Rotor AIR Tool Conservation Plan. Free on request.

THE ROTOR TOOL CO.
CLEVELAND, OHIO
AIR
HIGH CYCLE
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

nose-type collet chuck...

simplifies set-up

for ACCURATE

milling of pinions

Here's just one example of the way in which precision nose-type collet chucks can be quickly and easily adapted to handle work that might otherwise necessitate special equipment. The chuck is mounted on the dividing head of a standard milling machine and the work is the milling of teeth to close limits of accuracy on bevel pinions of special design. Collets have been machined to provide clearance for the milling cutters and, by changing to collets of different capacities, a variety of sizes of pinions can be handled.

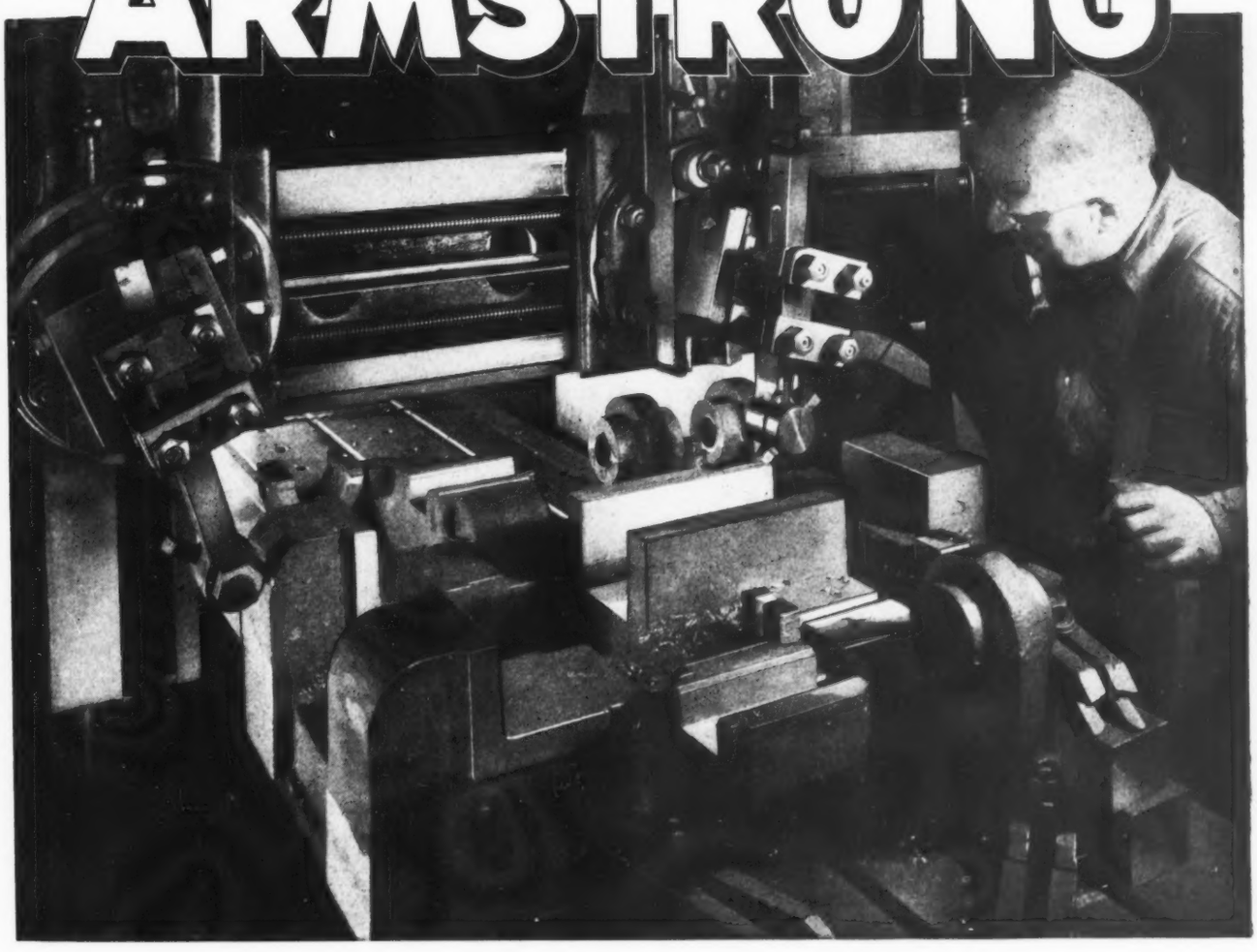
Especially important, in a set up of this kind, is the ability of the chuck to maintain consistent accuracy in centering of the work, a feature assured by the uniform full-length bearing grip of the collets in Cushman precision nose-type collet chucks.

Every day, Cushman Engineers are helping chuck users to solve special chucking problems presented by the many new types of work called for in armament production and to conserve and utilize to the full chucking equipment already available. Feel free to call upon us for the help you may need. The Cushman Chuck Company, Hartford, Connecticut.

CUSHMAN

A World Standard for PRECISION

ARMSTRONG



Use ARMSTRONG TOOL HOLDERS on Production Machines too

ARMSTRONG TOOL HOLDERS, usually thought of as tool room tools, because they are standard on lathes, planers, slotters and shapers in tool rooms everywhere, are proving to be the answer to many tooling problems on strictly production machines.

To the production department they bring the same advantages which have put them in over 96% of the machine shops and tool rooms.

- They have the strength to stand up to any speeds and feeds—to production speeds and feeds far in excess of those common in the tool room.
- They take cutters any operator can quickly grind from stock shapes of high speed steel.
- They reduce tooling-up to the selection of a cutter and adjusting it for clearance.
- They "Save: All Forging, 70% Grinding and 90% High Speed Steel."

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. Francisco Ave. Chicago, U.S.A.

Eastern Warehouse and Sales: 199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

Want Some Extra Production Capacity?

Put R&L Turning Tools to work on your turret lathes and screw machines. Their multiple operation features will give you an **immediate** increase in production capacity by enabling you to perform simultaneously combinations of operations such as drilling and turning; turning, centering and burnishing; pointing and form turning, etc. Further savings in time, all of which add up to increased production, are achieved with the exclusive R&L feature which makes possible a 10-second change from right to left hand operation. And, because they are simply, ruggedly built, they cut maintenance time to a minimum. If you are looking for extra production capacity—and need it quickly, write for the R&L Booklet showing the many time-saving operations possible with this one simple tool.

Also Manufacturers of the

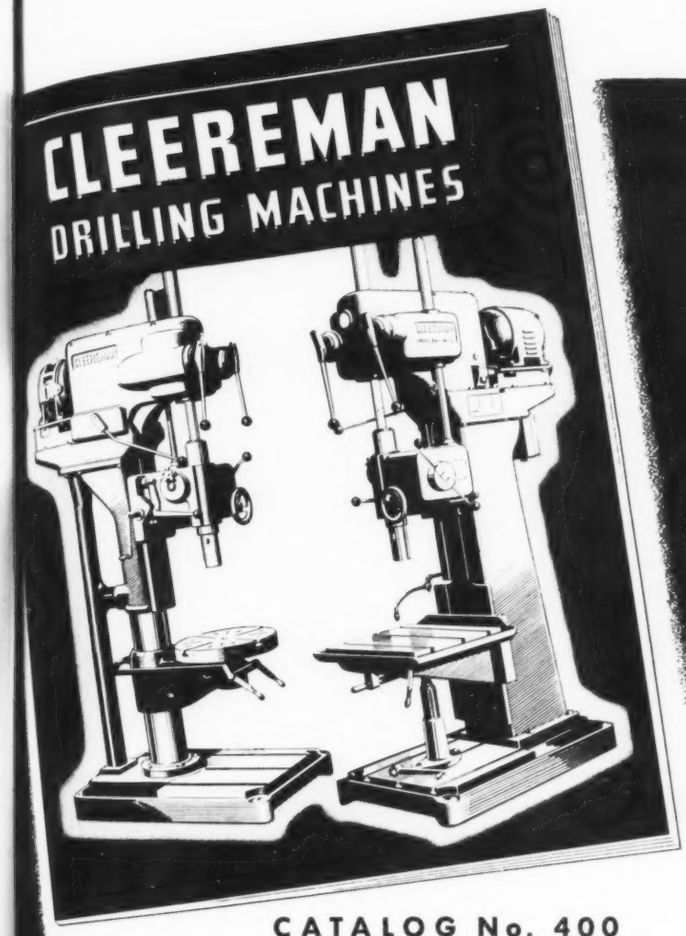
R and L TAP AND DIE HOLDER
R and L UNIVERSAL TOOL POST
R and L ROLLER BACKREST
for the R and L Turning Tool

RIGHT AND LEFT R AND L TOOLS

1825 BRISTOL STREET, NICETOWN, PHILADELPHIA, PA.

NEW! CLEEREMAN CATALOGS

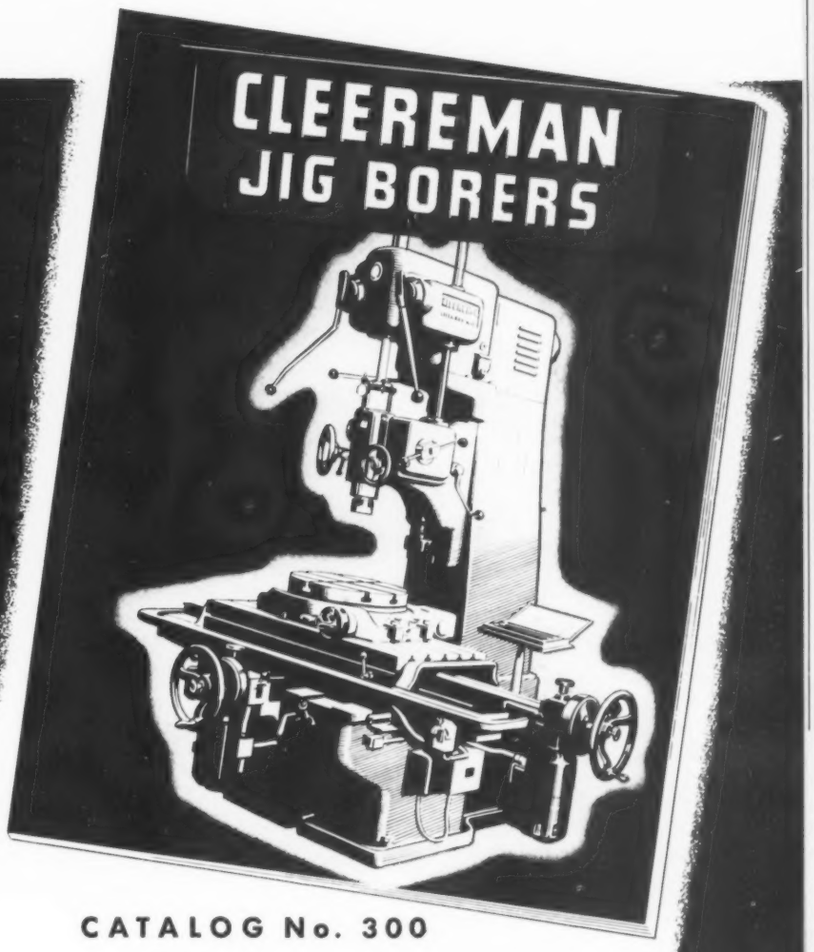
WRITE FOR YOUR COPIES TODAY!



CATALOG No. 400

CLEEREMAN DRILLING MACHINES

For high-speed drilling, boring, and tapping. Sliding head, round and box column types, in 21", 25", and 30" sizes. Wide range of speeds for drilling or boring 3/16" to 6" holes at proper peripheral velocity of tool.



CATALOG No. 300

CLEEREMAN JIG BORERS

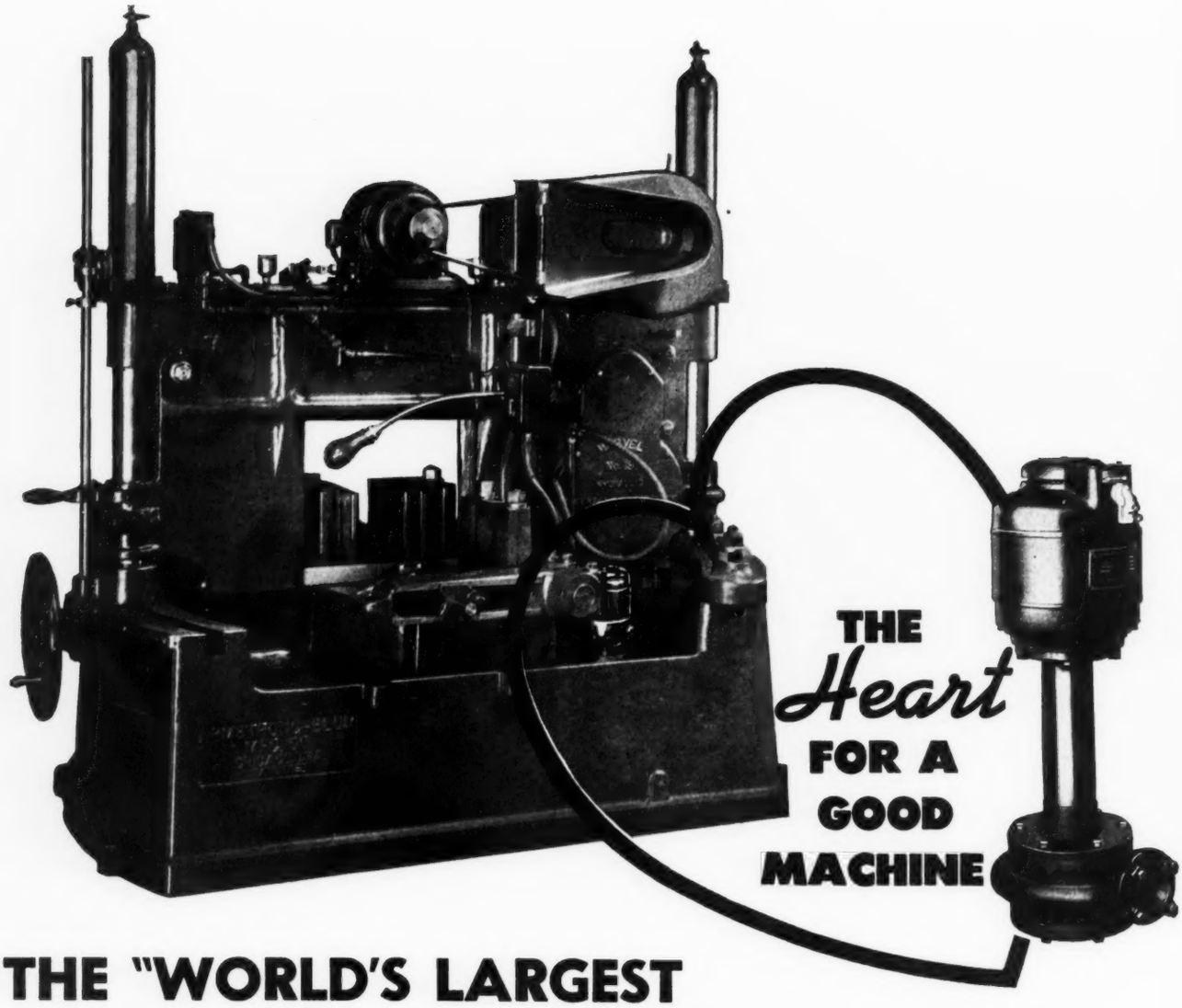
Constructed for extremely accurate production of jigs, tools, fixtures, dies, gauges, and precision machines. Extensively used for low-cost, small-quantity production of parts without the use of jigs and fixtures.

Cleereman now flies the Army-Navy "E" Flag

BRYANT MACHINERY & ENGINEERING COMPANY

Associated with **CLEEREMAN MACHINE TOOL COMPANY**

General Sales Offices 400 W. Madison St. • • Chicago • Ill. • U.S.A.



THE "WORLD'S LARGEST HACKSAW" . . . RUTHMAN EQUIPPED!

The No. 18 Marvel Sawing Machine is reputedly the "World's largest hack saw" and has a capacity for cutting-off 18" x 18" steel billets or multiples of smaller bars. Gusher Coolant Pump is shown immersed in the reservoir at the rear of the bed. Built in sizes to furnish any amount of coolant up to 200 gallons per minute, Gusher Coolant Pumps are easily mounted in a small space or adapted to any type of coolant tank. To meet the needs of each job, Gusher Pumps can be controlled to deliver a trickle of coolant or opened up to full capacity. Ruthman ball-bearing construction and its design that eliminates all packing nuts, foot and relief valves minimize interruptions of service and maintenance expense. Ruggedly built to stand up under wartime conditions of continuous operation, Gusher Coolant Pumps are an extra assurance of trouble-free machine operation . . . a heart that contributes to better war production.

THE RUTHMAN MACHINERY CO.
1809-1823 READING ROAD
CINCINNATI OHIO

EVERY MAN
COUNTS FOR MORE
USING SKILSAW TOOLS!
On any surface...on any war job
SKILSAW
SANDERS and GRINDERS
GIVE YOU
Finer Finishing Faster!
SKILSAW PORTABLE GRINDERS
Grind down raised welds faster. Light, compact, powerful. Perfectly balanced for easiest day-long operation. 2 MODELS.

SKILSAW DISC SANDERS
Speed up all metal cleaning, sanding, filing, grinding with wire brushes (*illustrated*) cup wheels, polishing pads, etc. 6 MODELS.

SKILSAW BELT SANDERS
Produce a smoother, better "final finish" *10 times faster than by hand* . . . on wood, metals, plastics, compositions. 4 MODELS.

Have you welds to grind . . . metals to clean or "final-finishing" to apply on wood or brass or steel? You can do each job better *and faster* with one of these SKILSAW TOOLS! They're specially designed for easier handling. They're skilfully engineered for greater output per man *at war-time production speeds.* They're ruggedly built to stand the gaff of toughest 3-shift operation without time-wasting breakdowns.

Do you wonder why these SKILSAW SANDERS and GRINDERS are favorites everywhere for coarsest grinding or finest buffing. Ask your distributor for a demonstration and see for yourself!

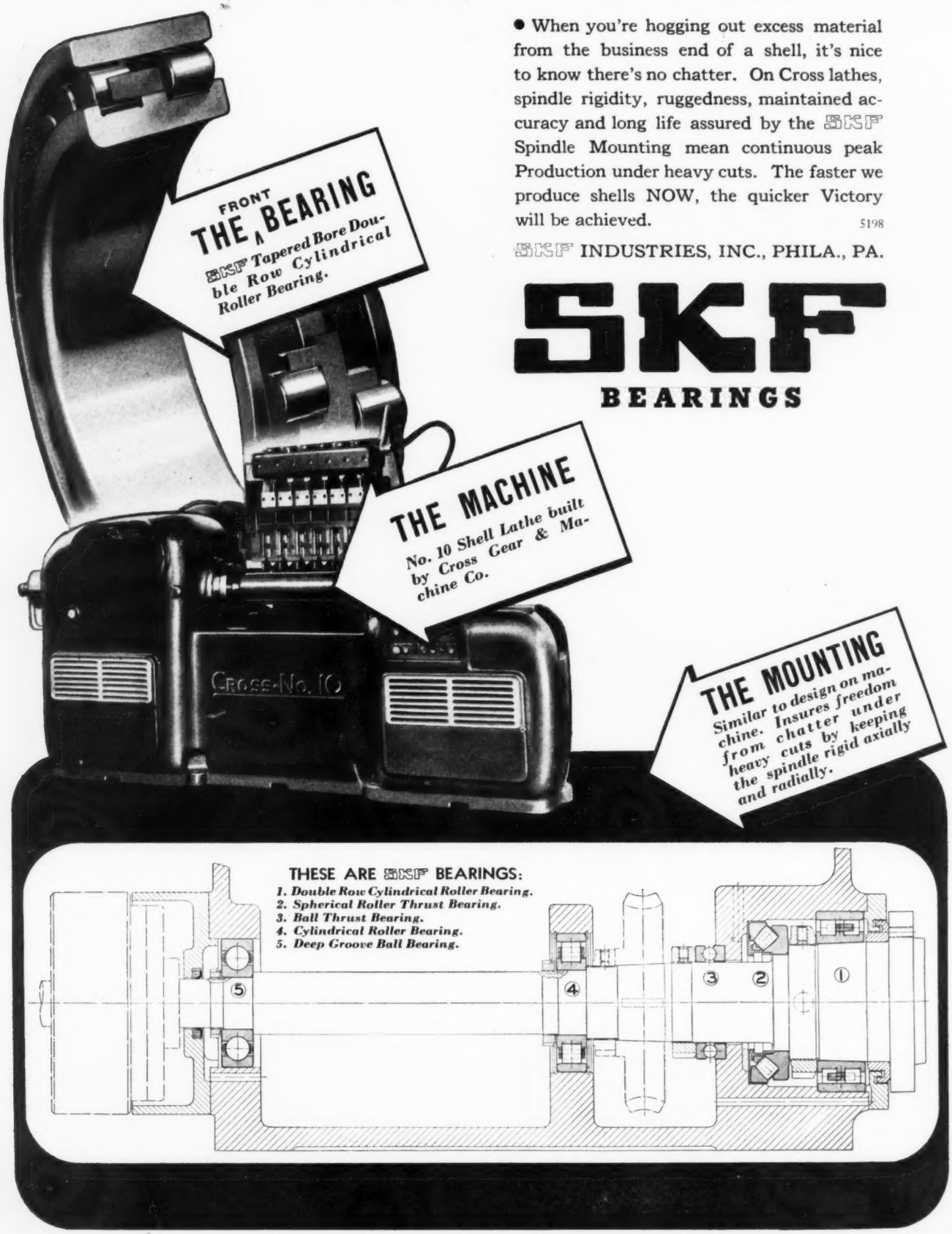
SKILSAW, INC., 5039 Elston Ave., Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Portland • Seattle • Toronto, Canada

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

TO *Prevent Chatter* UNDER HEAVY CUTS


FRONT
THE BEARING
SKF Tapered Bore Double Row Cylindrical Roller Bearing.
THE MACHINE
No. 10 Shell Lathe built by Cross Gear & Machine Co.
THE MOUNTING
Similar to design on machine. Insures freedom from chatter under heavy cuts by keeping the spindle rigid axially and radially.
Cross-No. 10
THESE ARE SKF BEARINGS:
1. Double Row Cylindrical Roller Bearing.
2. Spherical Roller Thrust Bearing.
3. Ball Thrust Bearing.
4. Cylindrical Roller Bearing.
5. Deep Groove Ball Bearing.
5
4
3
2
1

● When you're hogging out excess material from the business end of a shell, it's nice to know there's no chatter. On Cross lathes, spindle rigidity, ruggedness, maintained accuracy and long life assured by the SKF Spindle Mounting mean continuous peak Production under heavy cuts. The faster we produce shells NOW, the quicker Victory will be achieved. 5198

SKF INDUSTRIES, INC., PHILA., PA.

SKF

BEARINGS

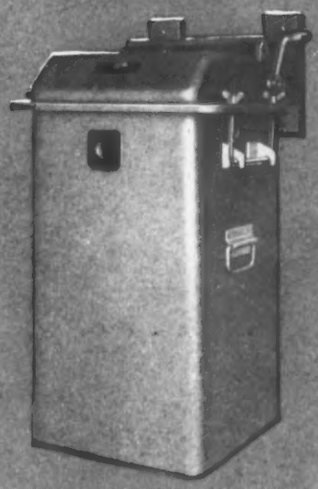
Don't

WASTE MAN-HOURS

AND CRITICAL MATERIAL

Building Special Enclosures

...there's a STANDARD G-E combination starter to meet every operating condition



CORROSION-RESISTANT

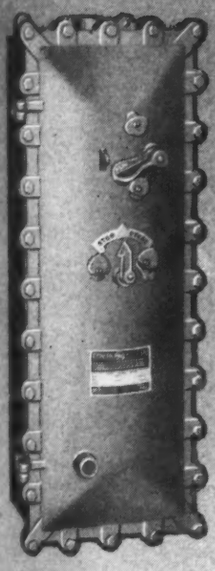
These starters (Type 8) are made in two forms—one for corrosive atmospheres and one for hazardous locations. All their arcing parts and terminals (for use in hazardous locations) are at least six inches under oil.

GENERAL-PURPOSE

The Type 1 enclosure is suitable for general-purpose, indoor applications where atmospheric conditions are normal.

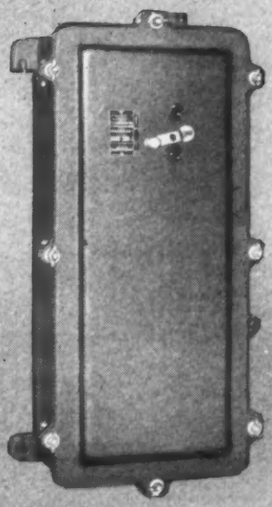
DUST-TIGHT

The Type 5 enclosure is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are of heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.



FOR HAZARDOUS LOCATIONS

The Type 7 case for Class 1, Group D, locations is made of cast, high-strength alloy. These starters can withstand internal explosions. The flanges, which are securely bolted on all sides, are ground to tolerances that will not permit the escape of hot gases.



WATERTIGHT

The Type 4 case is suitable for outdoor use, and for installations in damp places indoors, such as in dairies and breweries.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

Order STANDARDS *to save time and material*

NEVER ENOUGH production time—scarce material urgently needed! Both far too valuable to be spent in building unnecessary control rooms and special enclosures.

But delivered-ready-to-install control isn't all that the General Electric line of standard combination starters offers you.

These starters combine two devices—a fused motor-circuit switch and a magnetic starter—in one compact unit. This saves you one complete mounting job. They come to you completely wired and ready to install—saving all the time and material needed to wire up two individually mounted controls.

If you wish, our local sales engineers will help you select the proper starter for your job from this standard line of G-E combinations—for a-c motors up to 200 hp. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

578-83-8490

WE'VE MADE

-and not one has loosened

THEY'RE on oil well pumps—some for twelve years.

They're standard equipment on rock drills—industry's toughest fastening problem.

They're on tanks, planes, guns—all kinds of wartime material—all kinds of peacetime equipment.

All told, billions of Elastic Stop Nuts have gone to work.

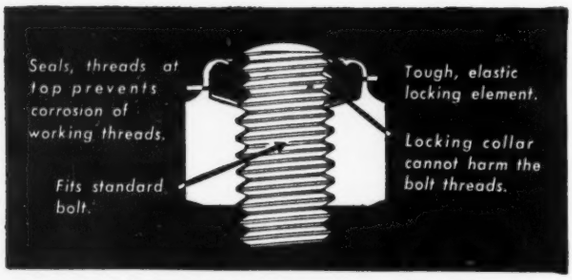
And as far as we know, not one has failed to do its job.

That job is to hold fast and stay put—come what may in the way of vibration, jar or chatter.

Of course the need for such dependable fastenings in war goods and planes is paramount. Some planes take as many as 35,000 in a single ship.

So even at our 4,000,000-a-day rate (which soon will double) the demand keeps growing.

But this constant call for more and more—to meet the exacting responsibilities of war—gives ample proof that Elastic Stop Nuts answer every need for secure locking and speedy fabrication.


Seals, threads at top prevents corrosion of working threads.
Fits standard bolt.
Tough, elastic locking element.
Locking collar cannot harm the bolt threads.

Write for folder explaining the Elastic Stop self-locking principle.

ELASTIC STOP NUT

CORPORATION OF AMERICA

2330 Vauxhall Road, Union, N. J.

FREE-

TO USERS OF H&G DIE HEADS

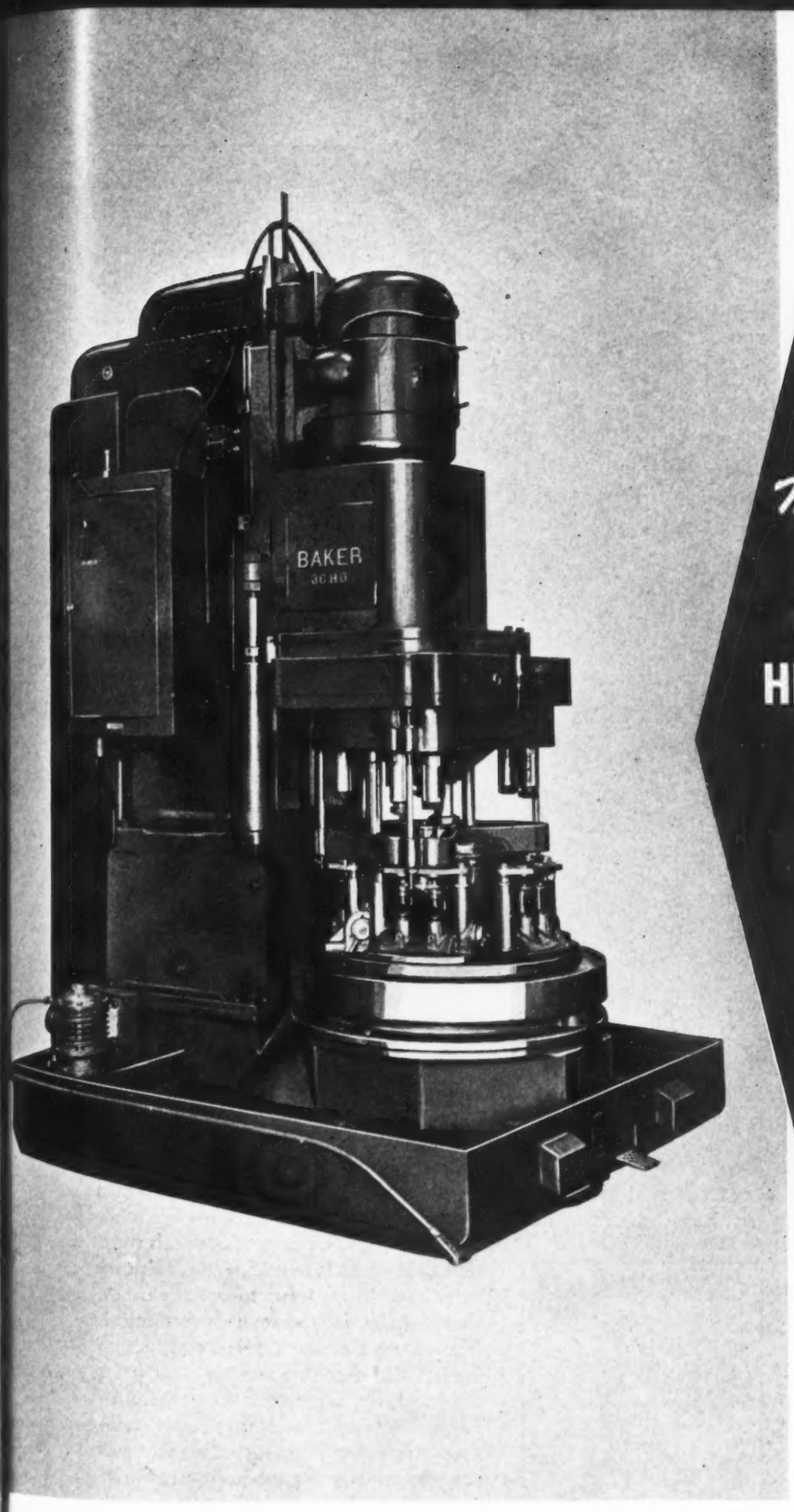
Instruction

BULLETINS COVERING

THE CARE OF GENERAL PURPOSE DIE HEADS
HOBBED CHASERS
GRINDING DATA ON INSERT CHASERS
STYLE MM (ROTARY) INSERT CHASER DIE HEAD
STYLE DMS INSERT CHASER DIE HEADS
STYLE DM INSERT CHASER DIE HEADS
STYLE TM TAPER CUTTING INSERT CHASER DIE HEAD
STYLES SAM AND SAMA SOLID ADJUSTABLE INSERT CHASER DIE HEADS
MODEL 1C THREADING MACHINE

In addition, as a part of our service we publish "DIE HEADLINES"—an informative bulletin packed with practical thread cutting suggestions for improving production, quality and volume. Give description of machine and size and style of H & G Die Heads used with your request.

The Eastern Machine Screw Corporation
23-43 Barclay Street New Haven, Conn.



Model 36-HO

VERTICAL CLEANLINE HEAVY DUTY MULTIPLE SPINDLE DRILL

BAKER

Efficient Set-up for Drilling Aircraft Engine Parts

The set-up illustrated on the Model 36-HO Machine has been engineered for fast production drilling on exhaust and intake rocker arms for a prominent Aircraft Engine... Speed, accuracy, ease-of-operation, rigidity, precision-construction, automatic-action and hydraulic feed are but some of the advantages which make this Machine ideal for these and similar heavy duty operations. Production is easily controlled to meet the high speed output demanded by wartime schedules, as indicated by the application of the Model 36-HO to crankshaft, gun parts, aircraft and various types of munitions parts. Engineering data sheet and full information will be sent promptly upon request to...

Baker Brothers, Inc. *Toledo, Ohio*

Single and Multiple Spindle Machines for DRILLING • BORING • FACING • TAPPING

MACHINE PARTS ARE

HARD TO GET

You can help make the machinery you now operate last much longer without trouble, delay and expense of repairs and replacements, by using Lubriplate lubricants.

Reports from industry everywhere are telling how Lubriplate lubricants are helping to prevent shut downs and repairs. Some of these stories are almost beyond belief.

Everyone engaged in war production owes it to his Government . . . owes it to himself . . . to see what Lubriplate lubricants will do to increase his production. Lubriplate is different. It is not to be compared with ordinary oils and greases. Lubriplate arrests progressive wear. It protects machine parts against rust and corrosion. It maintains a wear-resisting protective film on bearing surfaces. There are Lubriplate lubricants to meet all operating requirements, high and low temperatures, and in the presence of water and steam. Even under certain chemical conditions Lubriplate is performing in a manner that would be impossible with most conventional lubricants. Lubriplate outlasts ordinary lubricants many times, therefore it is extremely economical.

In these war days when production is vital and machine replacement parts are hard, or, impossible to get, Lubriplate lubricants will materially help keep machines running efficiently and at reduced power consumption. Write today for copy of "The Lubriplate Film" containing much valuable information.

LUBRIPLATE DIVISION

FISKE BROTHERS REFINING COMPANY

NEWARK, N. J. **SINCE 1870** TOLEDO, O.

WRITE FOR THE NAME OF THE DEALER NEAR YOU

This part produced in ONE forming cut by the

OSTER NO. 601

"RAPIDUCTION" TURRET LATHE

The part illustrated is one of numerous examples of heavy forming cuts obtained with the SIMPLIFIED Oster No. 601 "RAPIDUCTION" Turret Lathe, equipped with WORM DRIVE.

The hardened and ground steel worm, like the spindle, is mounted in ball bearings. A smooth, even flow of power is transmitted through a bronze worm wheel to the spindle. This smooth flow of power makes possible exceptionally heavy forming cuts with absence of chatter. (For high speed work on small diameters and non-ferrous materials, a DIRECT DRIVE is provided. Spindle speeds up to 3000 R. P. M. are obtained.)

The 6-station turret is now equipped with AUTOMATIC INDEXING. Price of complete machine is unchanged (Under $2000 without tools, F. O. B. Factory). The form below offers a convenient way to obtain full details QUICKLY. *Use it!*

No Time Out to Celebrate Our 50th ANNIVERSARY 1893-1943

OSTER

THE OSTER MFG. CO., 2073 E. 61st ST., CLEVELAND, OHIO, U. S. A.

★ O.K. Oster. We're interested in the No. 601 machine. ( ) Send Catalog No. 601. ( ) Ask your nearest distributor to see us at once. (Check either or both of above requests.)

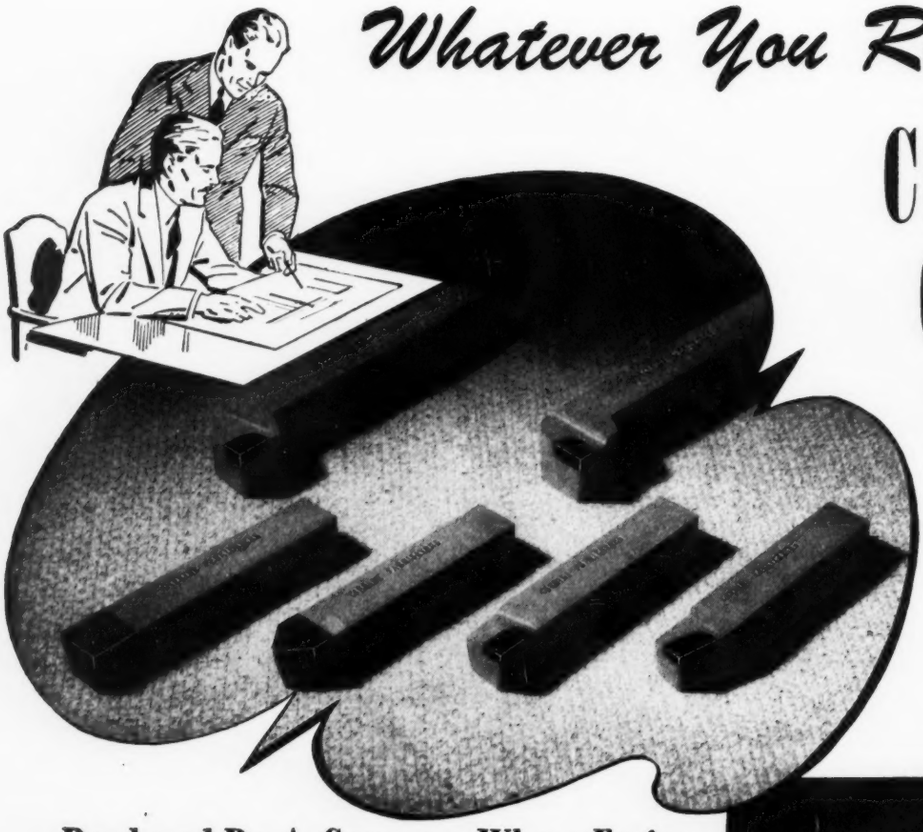
NAME .....

ADDRESS .....

CITY ..... STATE .....

Whatever You Require in

CEMENTED CARBIDE TIPPED CUTTING TOOLS

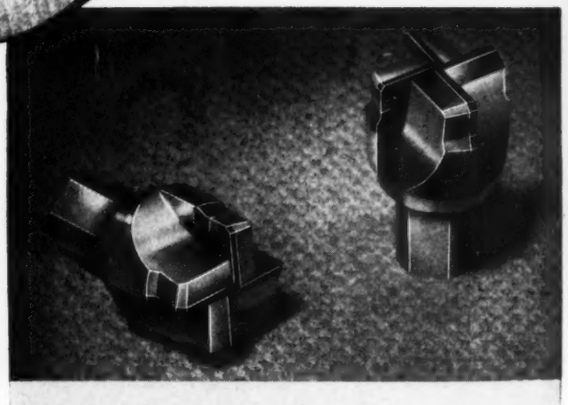


. . . Produced By A Company Whose Entire Facilities Are Devoted To Carbide Work

YOU NAME the cemented-carbide tipped cutting tool you need — Carbide Fabricators can supply it.

Standard tools are being produced in ever-increasing quantities. Some are carried in stock, ready for immediate delivery. In addition to the tools illustrated above, complete lines of other standard tools are listed as catalog items. Simplified methods of numbering and pricing eliminate much of the difficulty usually encountered in ordering the tools required for specific jobs.

Thousands of special tools have been manufactured by Carbide Fabricators to meet the specific requirements of many of the country's leading manufacturers. As this company is an authorized supplier of Carboloy, Vascoloy-Ramet and Firthite cemented carbides, individual preferences for wear-resistant materials can always be met when specified. Prompt delivery can be expected on practically all orders.



SPECIAL TOOLS

Directly From Your Blueprints

Illustrated is a two-step counterbore and chamfering cutter for four flute center cutting — just one of the many special tools produced by Carbide Fabricators. On inquiries regarding work of this nature, it is *essential* that we have your blueprints to furnish you with full information and prices.

CF *Carbide Fabricators Co.* ROYAL OAK MICHIGAN

MFRS. OF STANDARD AND SPECIAL CEMENTED CARBIDE TIPPED TOOLS

Cut Recruit Training Period of Your Screw Driver Army

ANYONE CAN DRIVE PHILLIPS SCREWS!

In many of today's war-expanded plants, *raw recruits* now literally walk from the employment office into responsible screw-driving jobs previously rated as skilled work. They produce efficiently, too, because the job is simplified and made foolproof by Phillips recessed head Screws.

The Phillips driver centers *automatically* in the recess . . . can't slip out to injure hands or spoil the work. This means centered *driving force* . . . no fumbling, wobbly starts . . . no slant-driven screws . . . no burred or broken screw heads.

Snug fit and perfect centering of driver in the Phillips Recess enable workers to make *uniformly tight* fastenings . . . and do it with *less effort.* Driving speed is often *doubled* because easy-driving, skid-proof Phillips recessed head Screws make power-driving practical!

They cost less to use! Compare the cost of driving Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Reading Screw Co., Norristown, Pa.
Pheoll Manufacturing Co., Chicago, Ill.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

What did *you* do today ... for Freedom?

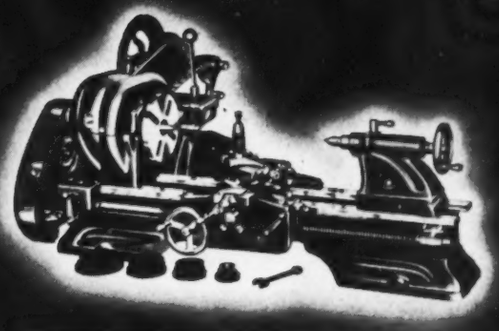
Today, at the front, he died . . . Today, what did *you* do?
Next time you see a list of dead and wounded, ask yourself:
"What have *I* done today for freedom?
What can I do tomorrow that will *save* the lives of
men like this and help them win the war?"

To help you to do your share, the Government has organized the Citizens Service Corps as a part of local Defense Councils, with some war task or responsibility for every man, woman and child. Probably such a Corps is already at work in your community. If not, help to start one. A free booklet available through this magazine will tell you what to do and how to do it. Go into action today, and get the satisfaction of doing a needed war job well!

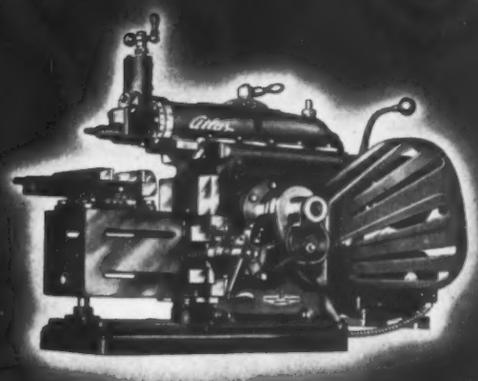
EVERY CIVILIAN A FIGHTER

CONTRIBUTED BY THE MAGAZINE PUBLISHERS OF AMERICA.

4 Atlas Recommendations To Speed Small Parts Production

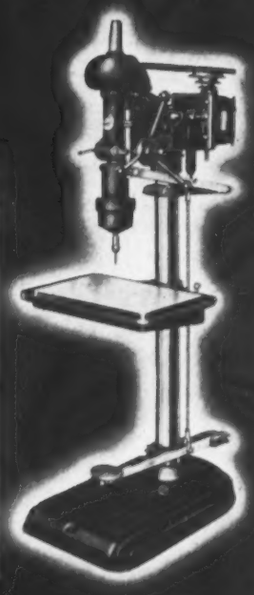


LATHES Precision-ground bed, V-belt drive, power cross feed, and available with Timken bearings for high speed production — turret attachments and lever-type collet for screw machine work. Atlas F-Series 10" Lathes are one of the busiest tools of this war production era.



SHAPERS handle all work within a 7" stroke. Have crank-type bull-gear drive, Timken tapered roller bearings, 4 speeds, 5 automatic cross feeds, complete V-belt drive. Operate on ½ HP 1740 RPM motor. Atlas Shapers are favorites in hundreds of vital war plants.

MILLING MACHINES Compact, powerful, Timken-equipped bench millers for tool room and production. Backgeared power, complete V-belt drive, twelve spindle speeds. Precision-ground table 4½" x 18", longitudinal table travel 10", cross travel 3½". Three models available.



DRILL PRESSES

The Atlas "floating drive" spindle design with 4 SKF ball bearings gives smooth, high speed performance hour after hour —month after month. Bench and floor models available — for drills up to ½" — also Multiple Spindle Drilling Machines and Drill Press Heads.

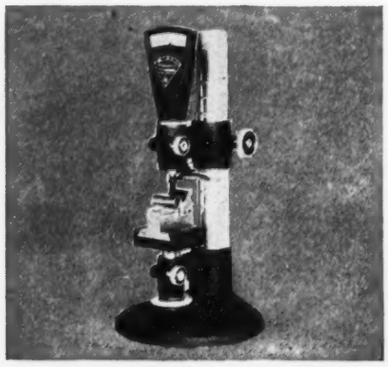
Atlas
ATLAS PRESS CO.

"MATCH THE MACHINE TO THE JOB — use fast precision bench tools to take over the production of small parts so that capacities of larger machines will not be wasted." That Atlas idea is helping thousands of the nation's foremost war plants, large and small, step up production in the victory program. If you have a small parts bottleneck, or can lift the production pace of your plant with strategically placed Atlas Equipment, ask your nearest Atlas distributor to give you complete specifications and work capacities of these modern tools. Atlas Press Company, 253 North Pitcher Street, Kalamazoo, Michigan.

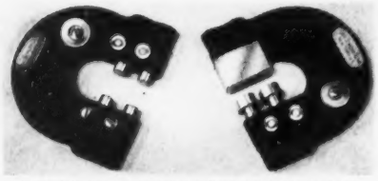
Current schedules call for prompt shipment of high priority orders. Whatever your rating, ask now for quotations and delivery expectancy.

ARMY E NAVY

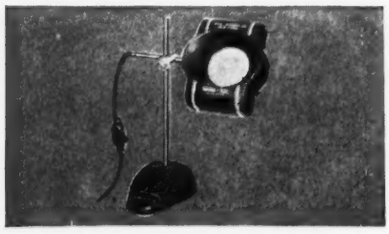
OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY



SCHERR COMPARITOL—for checking gage blocks, gages and work for size, accuracy and wear.

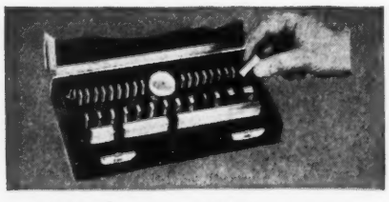


ATLANTIC ADJUSTABLE LIMIT SNAP GAGES—for accurate check-up, without having to depend on operator's skill. Sizes to 6".



MAGNI-RAY—a wide field illuminated magnifier for close inspection of work and operations.

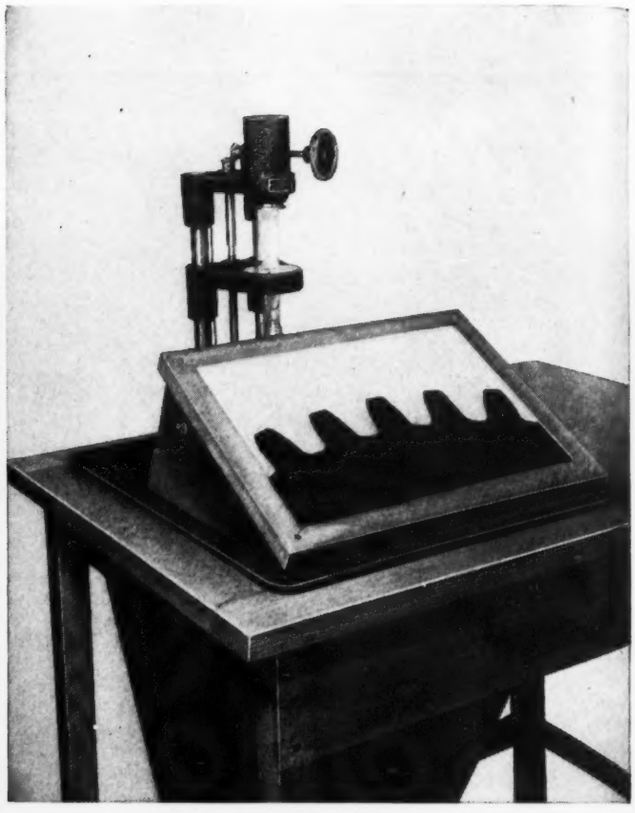
SPENCER BINOCULARS—for detecting surface finish, imperfections, etc., by means of 3-dimensional vision.



ULTRA-CHEX—a 34 block set accurate to .000008" and providing a basic standard of measurements.

Eliminate guesswork

INSURE ACCURATE INSPECTING and CHECKING WITH THE WILDER PROJECTOR



This instrument—at a price within the reach of any shop—is an optical device for measuring or comparing objects by means of a magnified image both in transmitted or reflected light. It provides a simple, accurate method of

. . . checking tools and gages to eliminate errors at their source.
. . . inspecting and measuring tool work, pivoted work and small screw machine parts of all kinds.
. . . verifying tool settings by checking first parts produced.
. . . controlling tool wear through periodic inspection of work.
. . . inspecting finished product.

One of the most useful applications of the Wilder Projector is that of checking threads. By means of this instrument it is possible to detect inaccuracies which cannot be seen with the naked eye nor felt by go and no-go thread plug and ring gages. Low initial cost will be repaid over and over again in savings from the prevention of spoiled work, which results from the use of this instrument.

Easy to operate, simple and sturdy in construction, the Wilder Projector offers many opportunities to speed up measuring, checking and inspecting.

CONDENSED SPECIFICATIONS

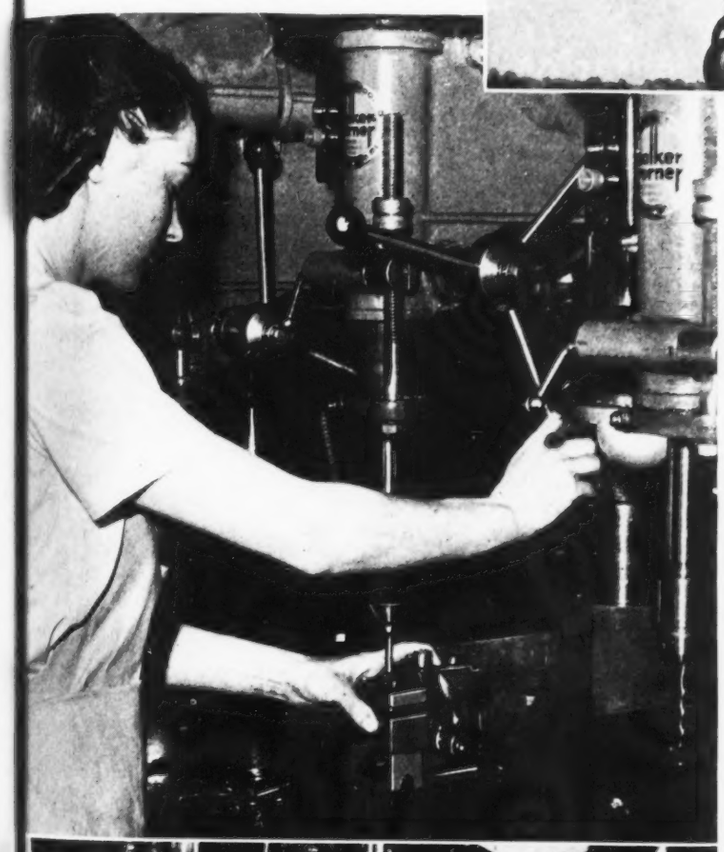
Standard Magnifications—10x to 100x
Space occupied in bench—21"x24"
Height over bench—18½"
Depth below bench—20"
Size of screen—10½x16"
Size of cross slide stage—6"x5"
Capacity between centers—5"
Maximum swing of centers—2½"

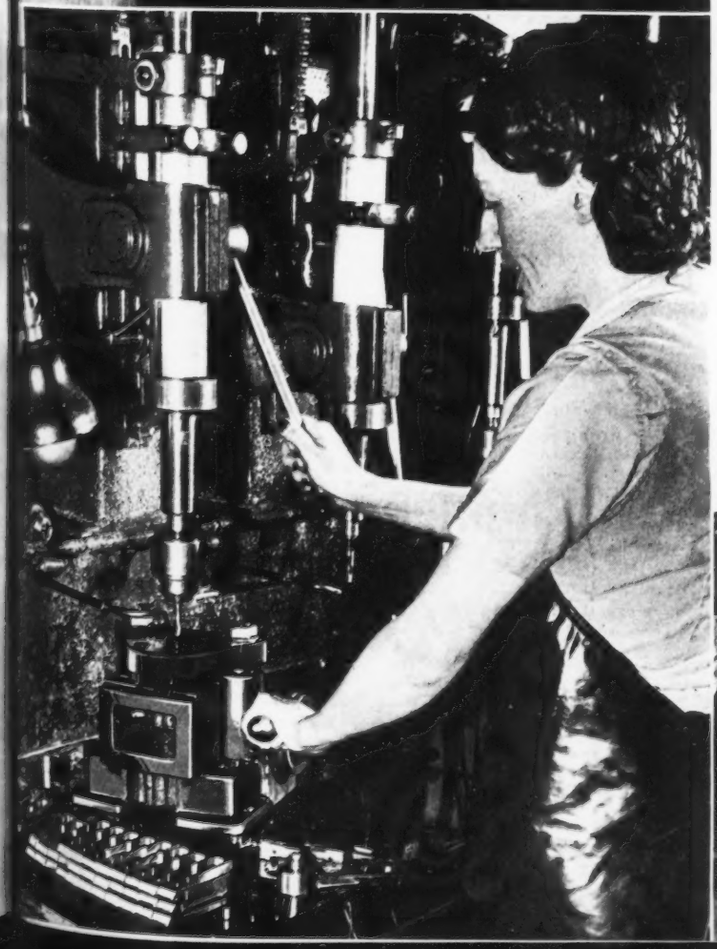
Write, wire or telephone (Canal 6-3512) for further details, quotations and delivery dates.

GEORGE SCHERR COMPANY, INC. 126 LAFAYETTE ST. NEW YORK, N. Y.

ALWAYS Ready for Action!

RIGHT: Army P-39 AIRACOBRA. All photos courtesy of Bell Aircraft Corp.

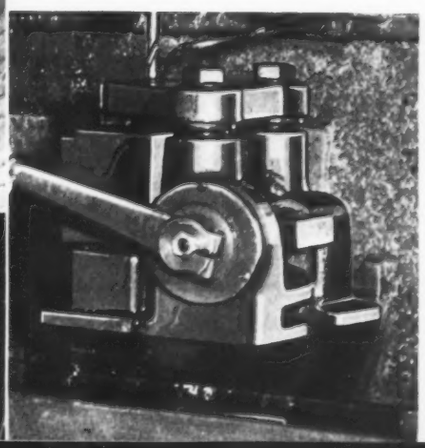




CLEVELAND UNIVERSAL JIGS

CLEVELAND UNIVERSAL JIGS are always ready to save time and assure uniform production on all types of machining operations. The photographs at the left and below are typical of the jobs of aircraft manufacture which are being speeded up with Cleveland-designed equipment. The parts being produced are important components of the Army's P-39 Airacobra—parts which require high accuracy in drilling and reaming. By facilitating handling and reducing the number of set-ups necessary, Cleveland Jigs are saving many valuable production hours on these operations. By making possible the use of unskilled operators for high precision work, by speeding each operation with their rapid, positive clamping and unclamping features, Cleveland Jigs are helping to increase production of vital war materials.

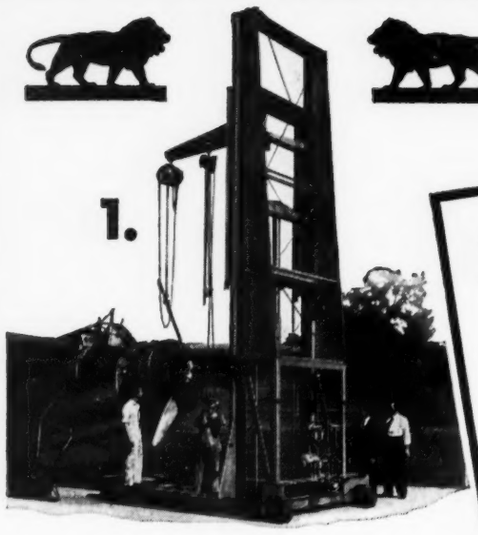
THE CLEVELAND UNIVERSAL JIG CO.
13404 St. Clair Avenue, Cleveland, Ohio

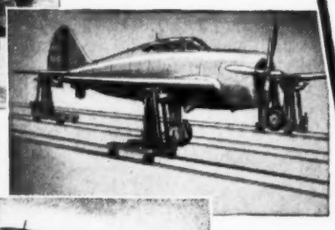


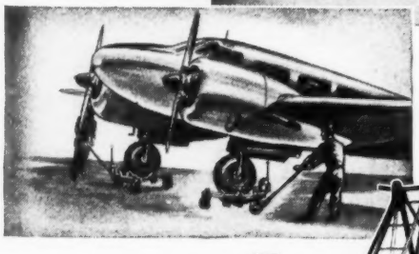
At LEFT: A close-up view of the jig shown in operation in the larger photo.

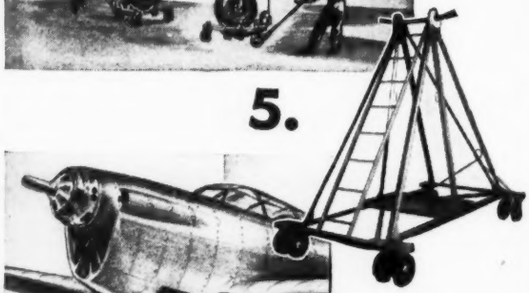
LYON-Raymond

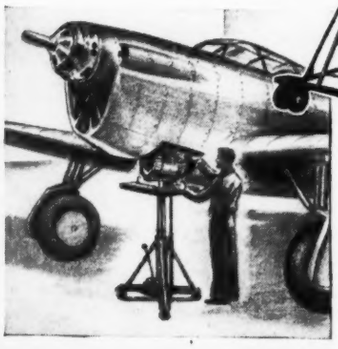
Specialized
Material Handling Equipment











Designed for the AVIATION INDUSTRY

TYPICAL DESIGNS ARE:

1. Hydraulic hoist for changing motors in bombing planes.
2. Cargo Handling Trailer with hydraulic elevating platform—for loading and unloading cargo planes.
3. Assembly line Portable Hydraulic Hoist—For positioning planes on assembly lines.
4. Hydraulic Spotting Dolly — expedites maneuvering of planes in limited space in hangars, factory floors or on Aircraft Carrier Decks.
5. Propeller Dolly—for transporting and storing propellers.
6. Portable Hydraulic Hoist—for positioning Superchargers in assembly line.
7. Portable Propeller Blade Rack—for transporting and storing propeller blades.
8. Hydraulic Elevating Work Stand—places workers at proper height for their jobs.
9. Hydraulic Elevating Hoist—for elevating crashed planes.
10. Cradle Type Trailer—for transporting damaged planes.

The above are only a few of the specialized material handling equipment devices that LYON-Raymond has especially designed for the Aviation Industry.

We may have something to meet your particular problems. We would welcome the opportunity to study your problems and submit designs of equipment to meet them.

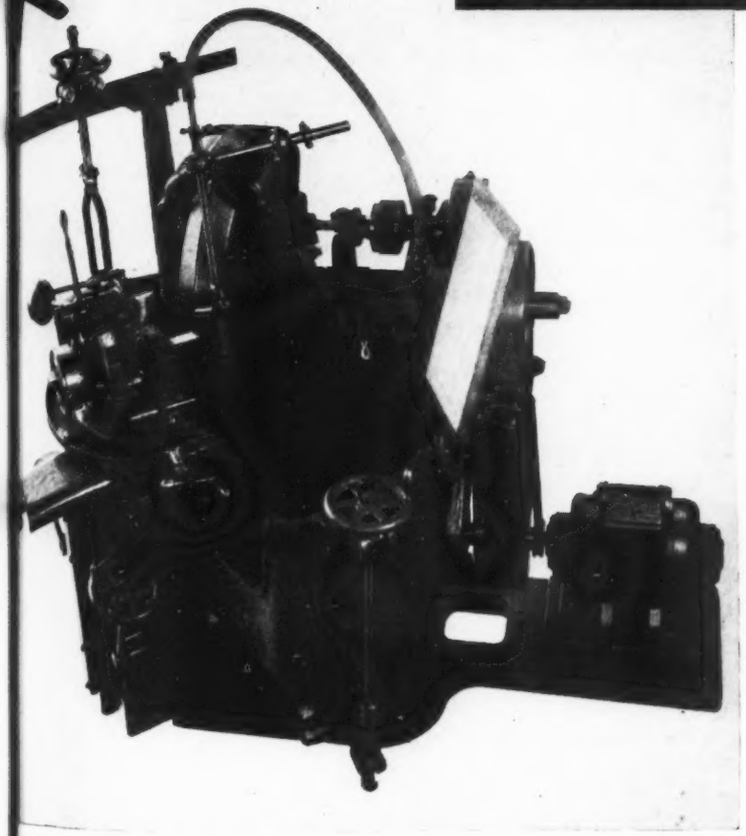
LYON-Raymond Corporation

213 Madison St., Greene, N. Y.

Material Handling Equipment for General Manufacturing
Hydraulic lift trucks — Hydraulic pallet trucks
Hydraulic elevating tables — Hydraulic die-handling trucks
Hydraulic sheet-handling trucks
Hydraulic stacking, tiering, and hoisting equipment
Special purpose production machines, hydraulic-powered

The Grinder Keeps 'Em Cutting The Girl Releases a Man

MARY JANE BLACKBURN OPERATES A SELLERS 6T-TOOL GRINDER IN THE SELLERS TOOL ROOM



SELLERS HEAVY DUTY TOOL GRINDING MACHINE SHOWING CENTRALIZED CONTROLS

THE SELLERS Heavy Duty Tool Grinder is a versatile, high production precision grinding machine for the modern tool room. It will grind any cemented carbide or high-speed steel, straight or convex, curved faced tools, including thread tools, at any angle of thread or pitch, internal or external, and will accurately reproduce the desired angles and clearances on all the tools. It effects savings in tools by removing the minimum amount of tool material, in production costs, by producing the exact shapes required to maintain high cutting speeds and in grinding time, by more rapid shaping and sharpening.

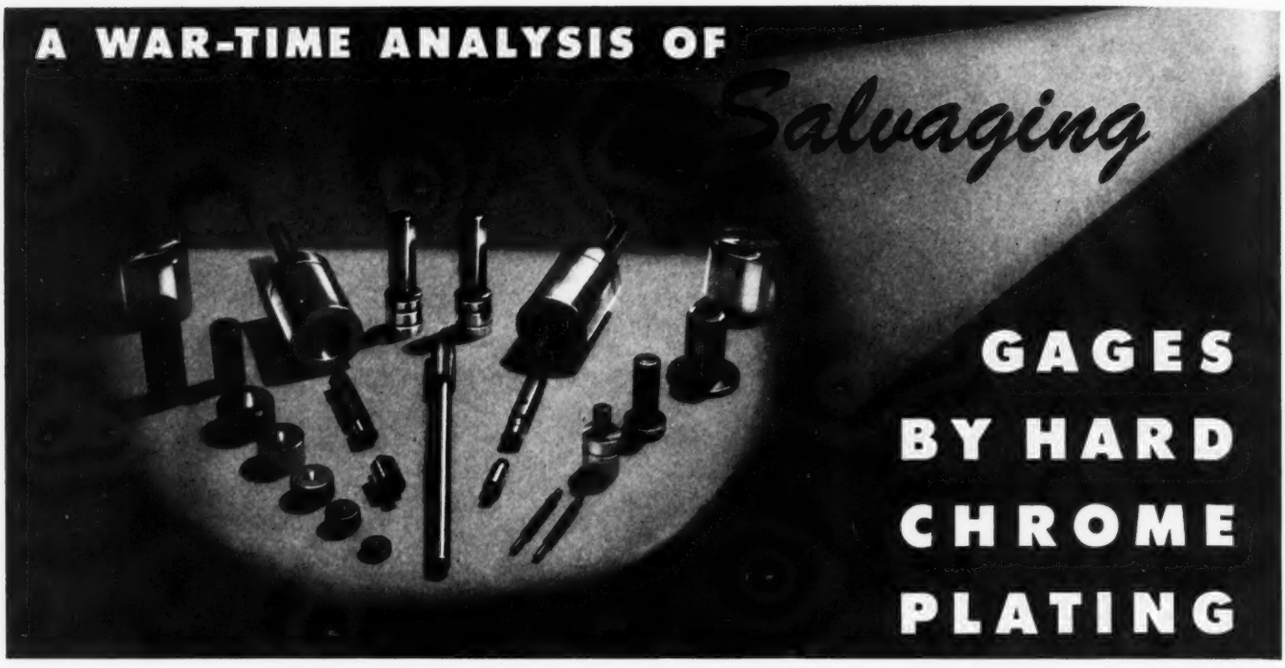
The simplicity of even the heaviest of the Sellers Tool Grinders and the accuracy with which it reproduces the exact shape, rake, and clearance angle at the cutting edge make it possible for women operators to keep up with the requirements of the busiest tool room, thus releasing men for skilled machine work or for the armed forces.

Sellers Tool Grinders are thus doing double duty on the production front.

WILLIAM SELLERS & CO., 1612 HAMILTON STREET, PHILADELPHIA, PA.

ARMY E NAVY

Sellers



Why can the chrome plate salvaging of your worn gages and non-cutting precision tools further the War Effort?

LONGER LIFE: The average wear-resistance of a Lincoln Park chrome plated gage is approximately five times that of a similar gage.

SAVES STEEL—With this salvaging service available, it is not necessary to discard your worn gages and non-cutting precision tools and order new ones which require the use of critical metals. Salvaging not only conserves the steel required for original manufacture but greatly prolongs the life of that over which the plating is applied.

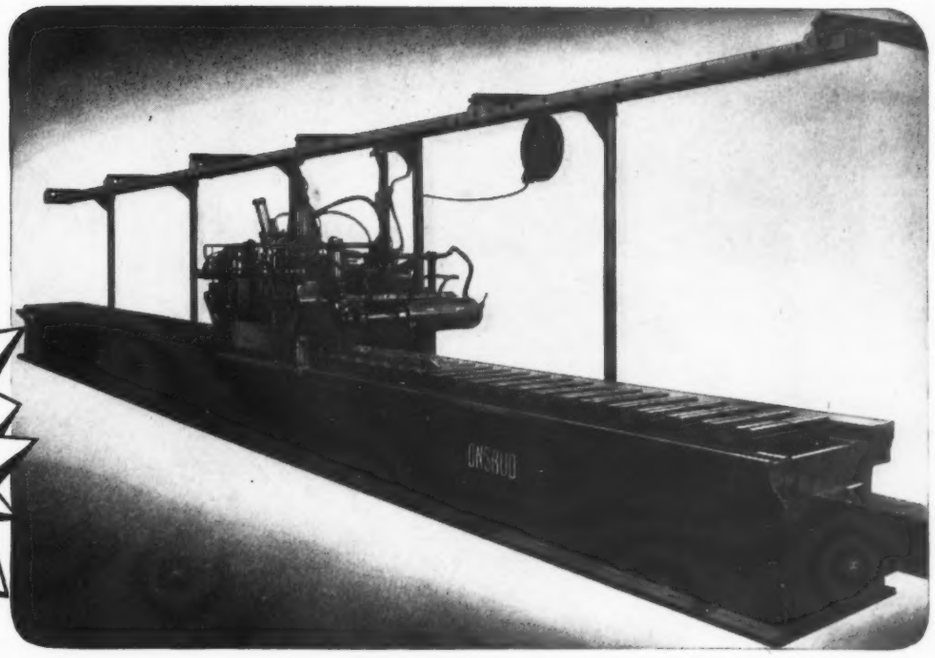
SAVES MAN AND MACHINE HOURS—When one gage is salvaged by chrome-plating, the manufacturing capacity required for the production of five ordinary gages is released for other vital work.

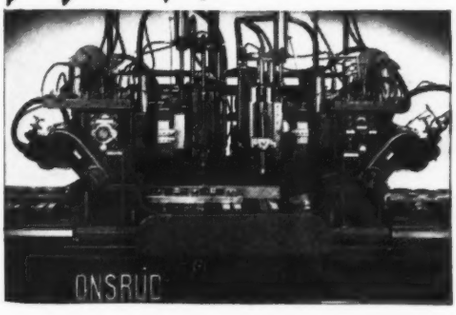
INCREASES MANUFACTURING TOLERANCES—With any gages, wear allowance must always be taken into consideration. However, when wear-resistant gages are used, it is obvious that the allowance for wear can be reduced considerably . . . automatically increasing the manufacturing tolerance. This slight extra percentage of tolerance becomes highly important when the dimensions of parts being inspected are very close to the required limits. It eliminates rejection of parts which should be accepted . . . and, in many cases, effects great savings both in expensive parts and man-hours.

Chrome plate salvaging is and has been for several years past—an important and highly specialized part of Lincoln Park's operations.

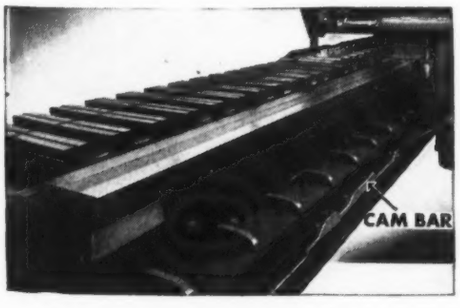
LINCOLN PARK TOOL and GAGE CO.
LINCOLN PARK, MICHIGAN

The Machine that *Blasts* Bottlenecks!





Complete carriage assembly showing cutter motors and front operating stations. G.E. Thy-mo-trol unit converts A.C. line to D.C. permitting use of D.C. carriage feed motor and stepless rheostat speed control.



A view of the Cam Bar for Automatic Feed Control to slow down or speed up carriage travel according to the cutting demands made by the work. Proper feed rate is automatically maintained.

The new Onsrud A80-A Automatic Contour Miller increases still more the type of high speed production machining originated by the Onsrud Spar Miller. This new machine brings to a high degree of perfection the new milling technique which is effecting such important savings in aircraft manufacturing man-power, time and machines.

Taking cuts in both vertical and horizontal planes in one operation, the A80-A greatly simplifies and speeds up production of long, intricate shapes from billets or extrusions. Features like the following are responsible for the machine's high production rate and capacity for unusual types of work.

Four Cutter Heads
Two vertical and two horizontal. Up to four cuts in one operation. One of the vertical heads tilts under automatic pneumatic control to make varying angle or twist cuts.

Variable Speed Carriage
The carriage rides on a precision machined bed to feed cutters to the work at any speed from 2″ to 18½′ per minute.

Sectional Bed Construction
Bed is made up of combinations of 7½ and 15 ft. sections to any length desired.

Open Grate Table
Built in 20 in. sections. "T" slots on 9 in. centers permit air or hydraulic clamps to be placed below table surface. Speedy loading and unloading results.

Extra Carriage Support
A removable front carriage support makes possible greater rigidity when work requires.

High Cutter RPM
Cutters are driven by individual motors with ample power to maintain cutting speeds for all types of cuts.

For a complete and detailed description of the A80-A send for bulletin. Draw on our long experience in the field of high speed cutting and machine tool design to help you solve your machining problems. Write today to the

Onsrud

ONSRUD MACHINE WORKS, INC.
3940 Palmer Street, Chicago, Illinois, U.S.A.
Sales Offices in all Principal Cities

MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

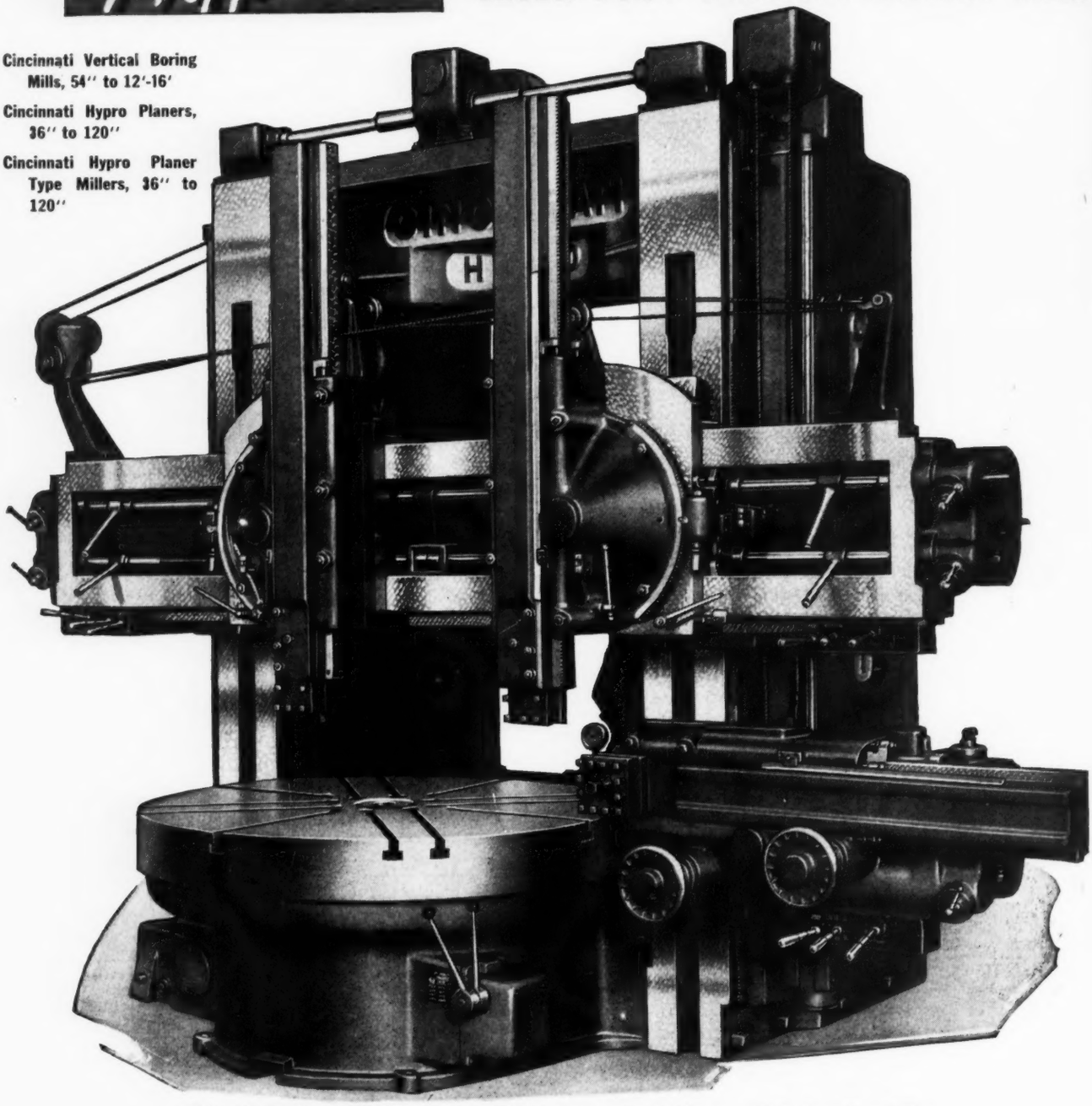
CINCINNATI Hypro

SEVEN FOOT VERTICAL BORING MILL

Cincinnati Vertical Boring Mills, 54" to 12'-16'

Cincinnati Hypro Planers, 36" to 120"

Cincinnati Hypro Planer Type Millers, 36" to 120"



This 7' Boring Mill is now available for early delivery. Side head saddle on the outside of the housing distributes stresses from heavy cuts over entire housing. WRITE FOR BULLETIN 125M.

THE CINCINNATI PLANER COMPANY

Planers . Vertical Boring Mills . Planer Type Millers

CINCINNATI . OHIO . U.S.A.

Follow this BASIC BEARING PRINCIPLE

★ for today's longer bearing life under continuous load!

★ for tomorrow's more compact design, more efficient performance, more economical maintenance!

★ for greater bearing capacity in any dimensional limit!

★

★ **ROLLWAY'S RIGHT-ANGLED LOADING...**
"better because it's simpler"

★ War has engineered complexity out of design, made simplicity a *"must"*. But in bearings—*the point around which most designs evolve*—Rollway's right-angle loading long ago reduced load problems to their two simplest components—*pure* radial and *pure* thrust.

★ The underlying principle is basic and universal. You *know* that every radial load and every thrust load is carried full-on, AT RIGHT ANGLES TO THE ROLLER AXIS. No oblique forces, no uncomputed resultants affect your design.

★ And every part of every load is supported by solid, cylindrical rollers of uniform cross-section. There's no weak point to invite stress localization, no wedging pressure, no danger of rollers pinching against the radius of the race.

Standard Sizes for Most Applications

S.A.E. or American Standard metric dimensions and tolerances are available for most applications . . . a wide range of sizes and types that are "engineered to the job." Avail yourself of Rollway's specialized bearing experience. Send your design or change-over sketch for free, confidential bearing analysis and recommendation. No obligation.

*TYPE MCS DOUBLE WIDTH RADIAL

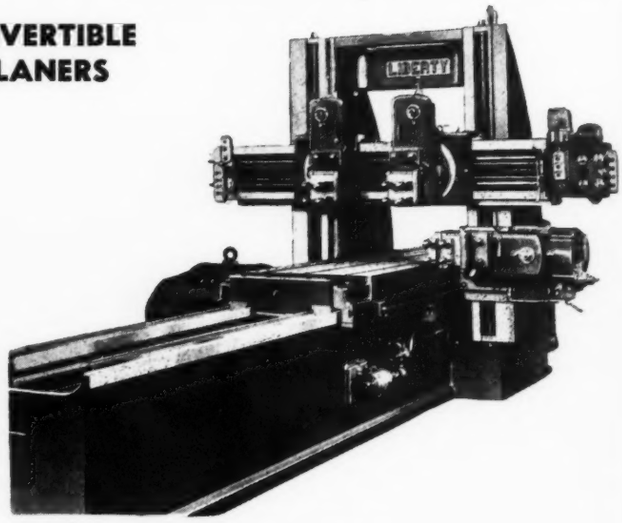
*TYPE SDT DOUBLE ACTING THRUST

ROLLWAY BEARING COMPANY, INC., SYRACUSE, N. Y.

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

LIBERTY PLANERS

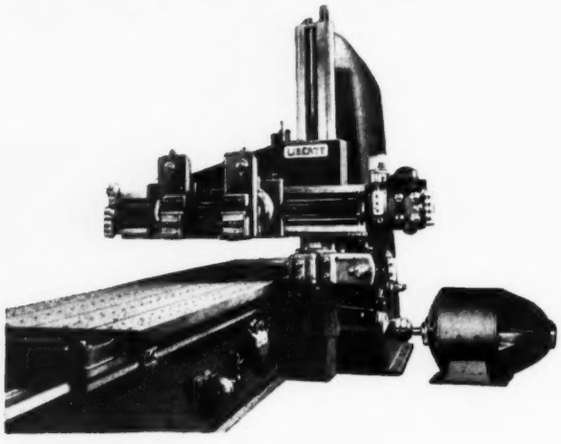
DOUBLE HOUSING—OPEN SIDE—CONVERTIBLE
DIE BLOCK—FROG AND SWITCH PLANERS



LIBERTY Double Housing Heavy Duty Planers

Double Housing Planers are ideally suited for large production on work lying within a defined range. Rigidly constructed, this Planer will handle precision work with utmost accuracy. Easy to operate. Constantly lubricated. Fully motorized for all automatic operation.

Sizes from 36″ to 132″ inclusive.



LIBERTY Open Side Heavy Duty Planers

The Liberty Open Side Planer will meet the requirements of the shop handling work of variable widths on a single machine. Extra wide faced housings for rigidity. Fast and accurate. Easy to operate. Fully motorized for all automatic operation. Constant lubrication.

Sizes from 36″ to 72″ inclusive.

LIBERTY Convertible Heavy Duty Planers

The Convertible Planer combines the versatility of the Open Side with the rigidity of the Double Housing. Left hand housing moves in and out, permitting use of side heads on unusual narrow work. Fast and accurate. Fully motorized for all automatic operation. Easy to operate. Constantly lubricated.

Sizes from 36″ to 144″ inclusive.

LIBERTY PLANERS of all sizes and types are in operation all over the world. Hundreds of shops now under severe war schedules are obtaining maximum results with Libertys.

Liberty Planers are manufacturers of Medium Duty and Standard Duty Planers in many sizes and styles as well as the Heavy Duty type illustrated on this page.

QUICK DELIVERIES

Delivery—three to four months
48″ x 48″ Double Housing Medium Duty Planers with 12′, 16′ or 20′ tables.

Delivery—five to six months
72″ x 72″ x 20′ Double Housing Heavy Duty Planers.

Delivery—four to five months
42″ x 42″ x 12′ Open Side Heavy Duty Planers.

Delivery—three to four months
30″ x 30″ x 10′ Open Side Standard Duty Planers.

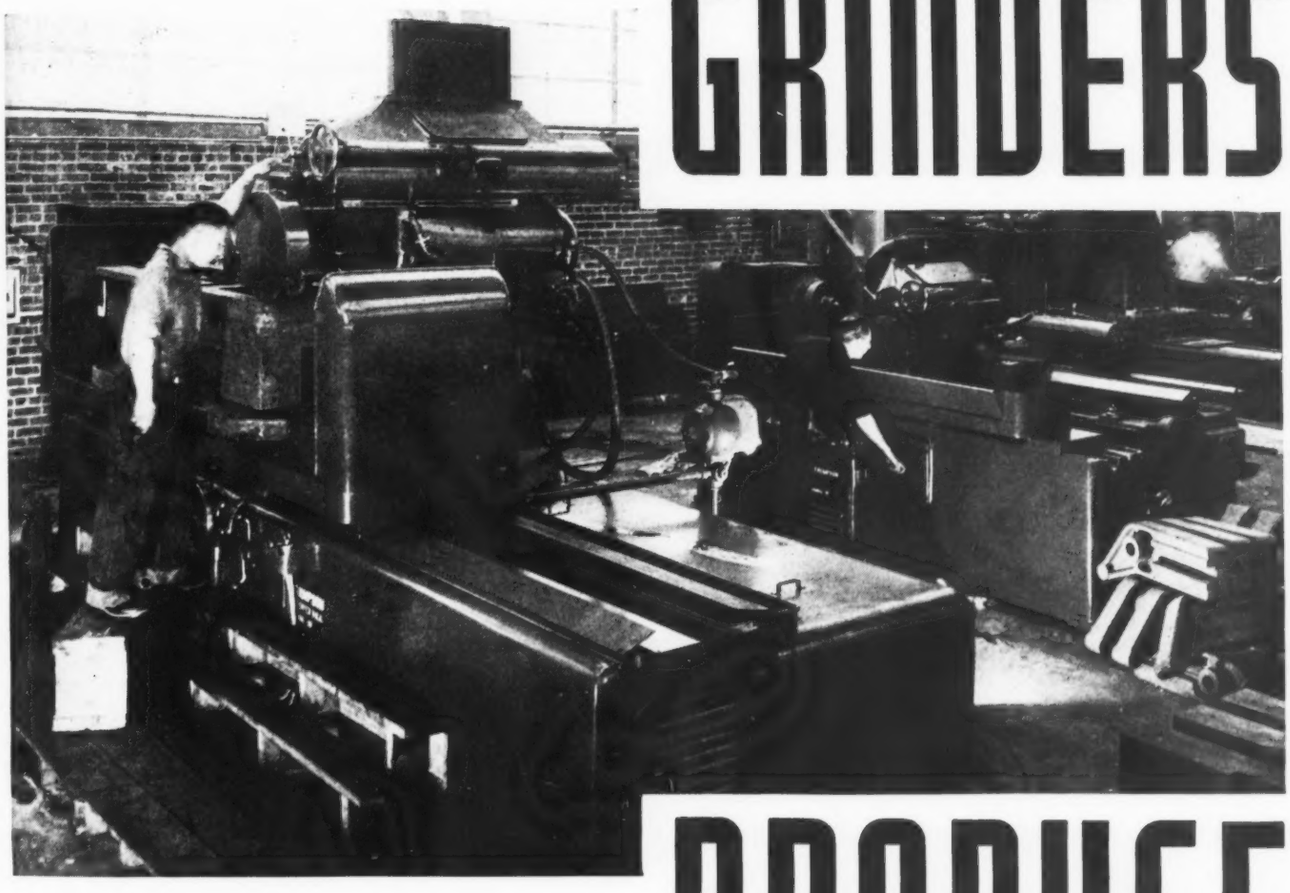
Delivery—three to four months
24″ x 24″ x 8′ Open Side Standard Duty Planers.

Consult our nearest representative or factory direct for information and data on planers.

LIBERTY PLANERS, INC.

1007 WELLER AVENUE **HAMILTON, OHIO**

THOMPSON GRINDERS



PRODUCE

MORE PARTS of Superior Finish FOR MORE MACHINES of WAR

More and more production is vital to our "all-out" War program—but that production must be to closer tolerances than ever before.

Thompson Grinders are helping hundreds of manufacturers keep in step with production needs and still meet exceptional demands for accuracy.

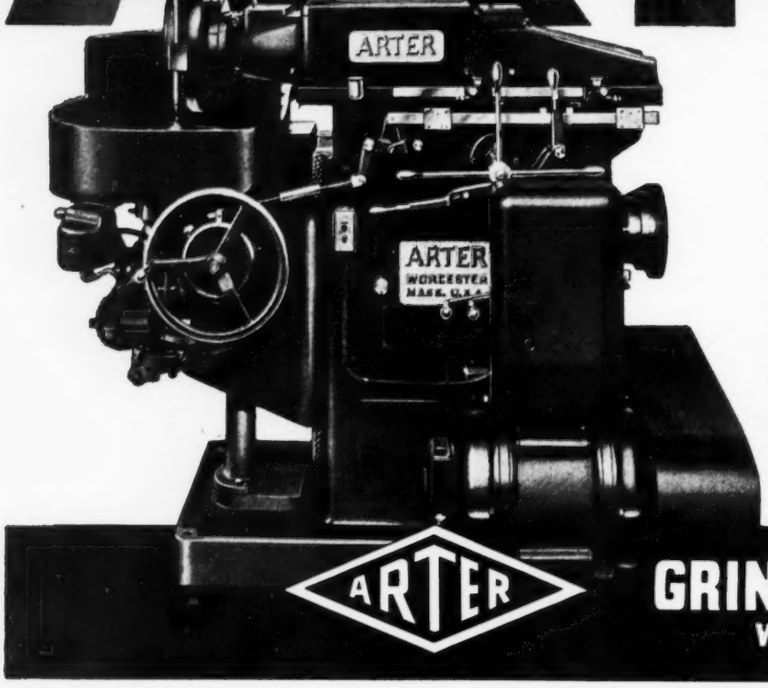
Illustrated is a C type Thompson Grinder finishing a Meehanite bed casting 24" high x 24" wide and maintaining tolerances for straightening.

The Thompson full hydraulic operation insures a smoothness that is reflected in the finish and accuracy of the work—and provides for the continuance of this dependable accuracy and smooth finish over long periods.

Get acquainted with the many advantages of Thompson Grinders—bulletins give complete details. Write for yours.

THE Thompson GRINDER COMPANY *Springfield, Ohio*

ARTER



Arter Rotary Surface Grinders made for fast, close tolerance work. You can depend on **Arter** for production-plus.

Arter Rotary Surface Grinders have great vertical capacity . . . give you simplicity of operation . . . extreme precision.

Are you getting all possible production from your grinders?

Arter grinding engineers will help you to secure **maximum precision production.**

ARTER **GRINDING MACHINE CO.**
WORCESTER, MASS. U.S.A.

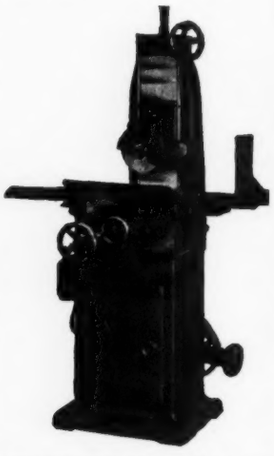
REID AUTOMATIC FEED SURFACE GRINDER

—a proven Product for over a Quarter of a Century

The No. 2A Surface Grinder will grind work 18″ long, 6″ wide and 11″ high, using a wheel 7″ in diameter.

Work Table, heat treated, 46″ long, 8″ wide, with a working surface 18″ x 6″. Table travel automatic in both directions. Spindle of chrome molybdenum steel, hardened and ground.

Machine requires a 1 1/2 hp., 1800 r.p.m. motor for operation. Mounted in base, fully enclosed.



THOUSANDS IN USE DAILY—
GOOD DELIVERIES

Exclusive Selling Agents

H. LEACH MACHINERY CO.
387 Charles Street Providence, R. I.
A Reid Distributor in all Principal Cities

KEEP YOUR WHEELS TRUE!

DESMOND DIAMOND HAND TOOL

DESMOND HEX DRESSER

Keep production high, accurate and uniform with well-dressed wheels! Because we manufacture a **complete** line, including diamond tools and nibs, we can advise you impartially and correctly on your every need. Write for illustrated catalog.

THE DESMOND-STEPHAN MFG. CO.
URBANA, OHIO

DIAMONDS for Victory

BIG-HED-NIBS
LOC-KEY-SET

RE-SET-ABLE
Cooler dressing
Closer Tolerances
Micrometer Accuracy
Because: Wing key heat dissipation and absolute diamond lock nib.

• Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6″ diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.) Grinders instruction card free.

Send specifications and prints for prices on turning and boring form tools.

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, *Pres.*
930 E. 41st Street CHICAGO, ILL.

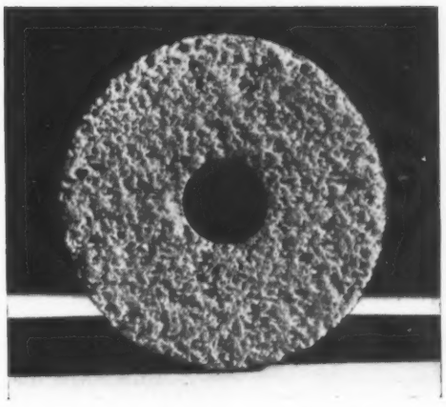
Which Wheel Structure for YOUR Job . . . *Dense, Medium, Open ?*

MOST ordinary tool and cutter jobs and surfacing jobs require either the fairly dense No. 5 structure or the medium No. 8 structure, the choice being dependent on the size and shape of the tool or part and the area of contact. There are jobs however where the Norton very open, No. 12, structure (illustrated) will be found best, such as:

(1) Surface grinding with periphery of wheel of hard, heat-sensitive steels.

(2) Hob grinding, especially when heavy cuts must be taken.

(3) Form tools or other grinding where accurate contours are required, except where acute included angles are involved. (Structure No. 12 wheels, because of their large pores, should not be trued to a sharp, thin point.)



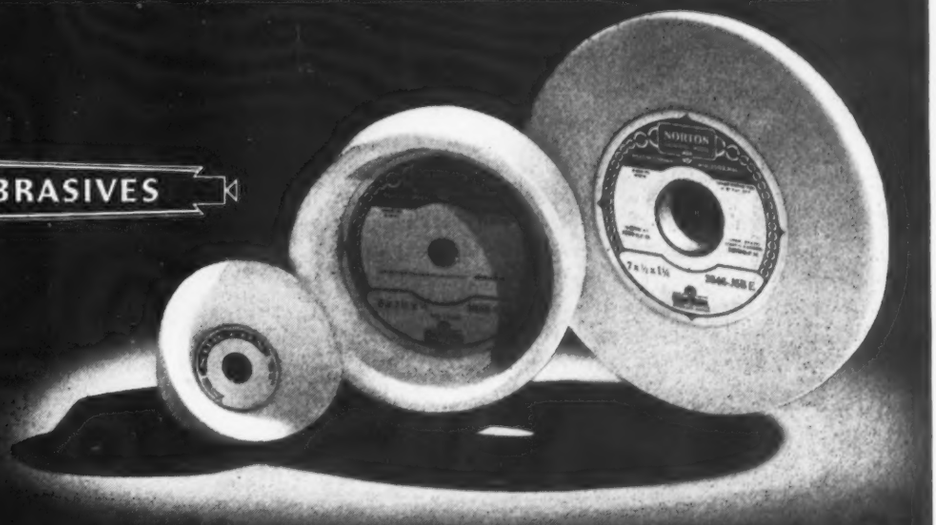
No. 12 Structure (Open)

Norton engineers will be glad to study your toolroom and surfacing jobs and select the wheel structure which will be best for each one.

NORTON COMPANY, Worcester, Mass.

W-899

NORTON ABRASIVES



DIAMOND•TOOLS

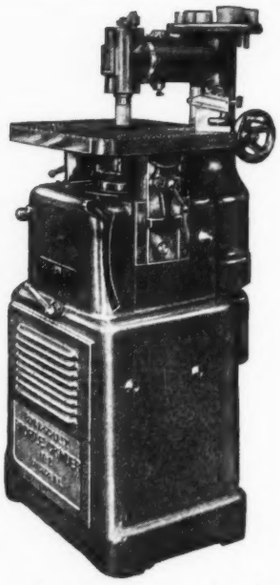
contain a number of small, whole diamonds which may be completely consumed without resetting. While they are mainly intended for finish grinding, they may be used on wheels of any size and hardness. Catalog on request.

J. K. SMIT & SONS, INC.
157 Chambers Street, New York

SECOMET Resinoid Bonded Diamond Wheels can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-bladed tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation. Catalog on request.

Prompt deliveries

J. K. SMIT & SONS, INC.
157 Chambers Street, New York



BOYAR-SCHULTZ
PROFILE GRINDER No. 2

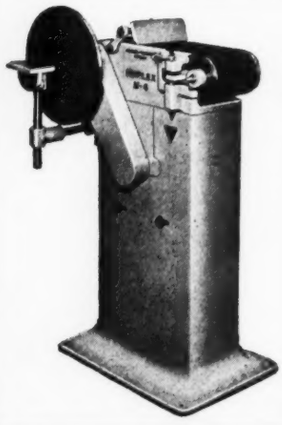
Speeds Contour Grinding in Production

Designed for intricate contour and profile grinding in tool and die work, Boyar-Schultz Profile Grinder No. 2 is now making a noteworthy contribution to the war effort on the production lines of plants making aircraft, guns, tanks and other heavy munitions.

This Grinder has two grinding spindles, each operating at the high speed of 10,000 R.P.M. making it a specially versatile machine tool; one that fits into efficient production as readily as it has in tool and die work.

Write For Full Information

BOYAR-SCHULTZ
Walnut Street at Hoyne. CHICAGO, ILL.



New Time Saver For Busy War Plants

DUPLEX M-6

BAND AND DISC GRINDER

- 14" steel disc and ample grinding table for rough work.
- 6 x 48" abrasive band for perfect, straight grain finishing. 7¾ x 14" grinding table.
- ¾ H.P. motor—fully enclosed V-belt drive.
- Ball bearing throughout—Alemite lubricating system.
- All-around economy for plants of all sizes.

Other styles and sizes in New Booklet on Finishing—Write Today

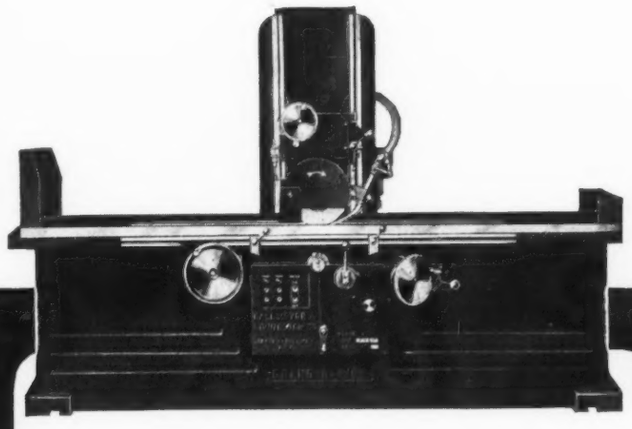
WALLS SALES CORP.
96 Warren St., New York, N.Y.

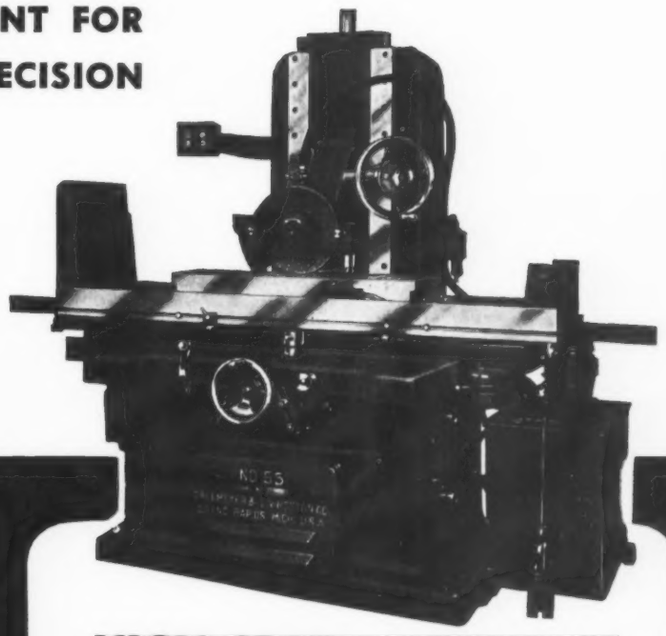
JONES MACHINE TOOL WORKS, Inc.
Manufacturers of
VERTICAL SHAPERS • SLOTTERS • STRAIGHT EDGES
VERTICAL BORING MILLS
HORIZONTAL BORING MILLS
SURFACE PLATES AND SPECIAL MACHINERY
Temporary Office: 5300 Lansdowne Ave., Philadelphia, Pa.
Plant Near Valley Forge, Pa., Route 23

SMITH & MILLS
CRANK SHAPERS
Sizes 12" to 32" stroke
THE SMITH & MILLS CO., Cincinnati, O.

TOOLROOM or PRODUCTION GRINDING . . . . or BOTH?

GRAND RAPIDS SURFACE GRINDERS FULFILL EVERY REQUIREMENT FOR EFFICIENCY, SPEED AND PRECISION





CROSS-TRAVELING HEAD PRODUCTION GRINDERS

Grand Rapids Model A Surface Grinders incorporate features especially designed for accurate high speed production. These machines feature the use of a wide faced wheel and have a maximum cross feed of 1½" per table reversal. A 14" x 3" wheel is standard equipment, giving a capacity of 17" under the full 14" diameter. Within easy, instant reach are all controls for feed and speed of table, vertical movement and cross travel of wheel head. Graduations of .0001" on wheel controlling vertical movement of head are ⅛" apart, making it easy to split "tenths" on regular production operations. Massive construction of column and base insures continued accuracy under "7-day-week" operation. Table speeds are infinitely variable from 10 to 125 feet per minute.

Built in table widths from 12 to 18 inches, table lengths from 3 to 6 feet, Grand Rapids Model A Surface Grinders are contributing speed, capacity and precision to munitions grinding jobs of every size and description.

Described in Bulletin GL-115

HIGH SPEED PRECISION TOOLROOM GRINDERS

Grand Rapids Toolroom Type Surface Grinders are built to produce results that meet the highest aircraft and ordnance specifications. Their massive, one-piece column and base construction assures permanent alignment of vertical and horizontal ways. Rigid, precision-mounted spindle can be controlled vertically well within limits of .0001". Hydraulic table feed produces smooth work, free from "gear marks" and permits speeds to be infinitely varied for best finish and maximum production. Both table speeds and spindle elevation are adjusted by means of convenient, positive controls. Widely spaced graduations assure precision control of vertical spindle movement. "Tenths" can be split accurately.

Illustrated above is the No. 55 Hydraulic Feed Grinder, one of the complete range of sizes with capacities from 6" x 10" x 18" to 14" x 17" x 48" — all capable of attaining production speeds on jobs requiring toolroom precision.

Described in Bulletin GL-100

GALLMEYER & LIVINGSTON CO.

305 STRAIGHT AVE., S. W., GRAND RAPIDS, MICH.

THEY STAY TRUER . . . LONGER

High quality grinding becomes high economy grinding with VITRIFIED WHEELS. They stay truer—longer. They will not gum or glaze. And they are not affected by heat, cold, oils, or acids.

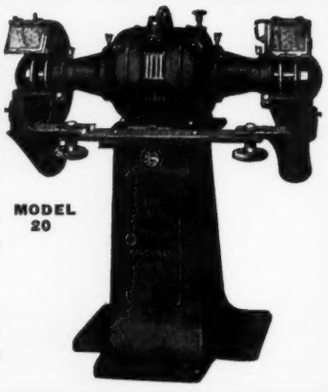
Let our engineers study your grinding jobs and make recommendations for greater service and economy. No obligations, of course.

VITRIFIED WHEEL CO.
Westfield, Mass.

HEAVY DUTY WIDE TYPE GRINDER

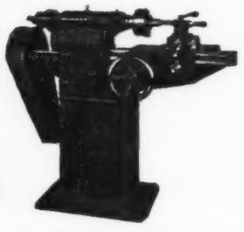
for 12 to 20" wheels

Save on wheel maintenance because adjustable to wheel wear. Heavy duty ball-bearings support one-piece alloy steel spindle. For continuous service. Rugged construction eliminates vibration and cuts down wear.



UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

FISCHER OIL GROOVERS



. . . are saving money in shops all over the country in the production of straight or spiral internal or external grooves. Can be equipped with high speed chucking attachment for high production operation. Two sizes, for work up to 15" in length. Write for catalog.

Three to four months delivery

FISCHER MACHINE CO.
310 N. Eleventh St., Philadelphia, Pa.

BALDOR

Special GRINDER for
CARBIDE TOOLS

Precision-built for accurately and quickly sharpening Carbide Tools. Sturdy ½ h.p. ball-bearing, reversible motor; 6" Silicon Carbide wheels and large adjustable tool-rest tables. **$95**

1 Year Guarantee

We also manufacture
GENERAL PURPOSE GRINDERS
ELECTRIC MOTORS
ELECTRIC MOTOR BUFFERS
BATTERY CHARGERS for Industrial and Automotive use. *Write for Bulletins.*

BALDOR ELECTRIC CO.
4400 Duncan Ave., St. Louis, Mo.

The BARNES Motor Driven Precision Cutter Grinding Machine

For Precision Grinding Formed Milling Cutters Used in the Manufacture of Rifles, Pistols, etc.

Write for bulletin giving complete description.

GENERAL MACHINERY CORPORATION
140 Federal St., BOSTON, MASS. Telephone Liberty 4826

Promptly made to your specifications—any size or style perforations, any metal, any gage or size sheet. Write us.

CHICAGO PERFORATING CO.
2419 W. 24th Place Chicago, Ill.

BAY STATE
WHEELS & POINTS
WHEELS of PROGRESS
BAYSTATE
THE BAY STATE METHOD OF FORMING FROM UNIFORM BLANKS IS REALLY SOMETHING! -SEND FOR HELPFUL CATALOG, DESCRIPTIVE FOLDER AND STOCK LIST.
BAY STATE
ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

LET'S FINISH THE JOB THIS TIME!

A HILL HYDRAULIC SURFACE GRINDER WILL HELP

★ Concentration of Man Power plus Machine Efficiency will win the War. Undoubtedly your production operations can be accelerated by using HILL *"Open Side"* Hydraulic Surface Grinders. HILL Heavy Duty Grinders are ideal for production operations—incorporating the two vital characteristics of speed and accuracy. They are built to *FINISH THE JOB!* Our experienced staff will assist you in selecting the correct type of HILL *"Open Side"* Hydraulic Surface Grinder best suited to *your* increased production needs.

18" x 18" x 60" HILL *"Open Side"*, Vertical Spindle Surface Grinder, with 12" x 48" HILL Rectangular magnetic chuck, operating in a Canadian munitions plant.

The HILL ACME CO.

6400 BREAKWATER AVE. • CLEVELAND, OHIO

HILL *"Open Side"* Surface Grinders are built in both Horizontal Spindle and Vertical Spindle types in a full range of sizes with table dimensions 18", 24", or 30" wide and 5 to 20 feet long.

VERSATILE.. *Plus!*

THE GREENFIELD TOOL AND CUTTER GRINDER

In addition to tool and cutter grinding of all kinds, the Greenfield No. 4 Grinder can be equipped for cylindrical grinding on work up to 3" diameter by 12" long and internal grinding on work up to 4" in outside diameter by 5" long. Head, table and spindle construction are extra heavy and controls are accurately graduated for ease in obtaining precision settings.

Use the Greenfield Tool and Cutter Grinder for precision work of all kinds. It will pay for itself many times over in tools and time saved!

WRITE FOR BULLETIN GIVING FULL DETAILS

PRODUCTION MACHINE COMPANY
GREENFIELD, MASS.

Superbly Accurate, Speedy and Convenient

WARDWELL No. 57T Automatic Circular Metal Saw Grinder

Fully automatic and precise sharpening of slitting and screw slotting Saws and Milling Cutters. Capacity includes saws up to 8" in dia., in range up to 3¾" thick. Automatic indexing and accuracy within ± .001" of exact diameter of entire lot. This Machine pays for itself many times over — a "must" for Economy in high production shops. Illustrated Bulletin gives all details.

THE WARDWELL MFG. CO.
3168 Fulton Rd. CLEVELAND, OHIO

For Your ATLAS and LOGAN 10' LATHES

Precision Collets and DRAWBARS

IMMEDIATE DELIVERY . . . Also available are Drawbars for the 9" SOUTH BEND Lathe. Ready March 15th, Collet Model 3C fitting 9" South Bend, and Clausing Lathes, etc. Guaranteed unconditionally, Precision products are sold by distributors throughout the United States and Canada.

Literature on request.

GENERAL DIE-STAMPING-TOOL COMPANY
PRECISION COLLET CO. DIVISION • 265 Canal St., New York City

The ABRASIVE No. 1½ Hand Feed Surface Grinder

★

The Abrasive No. 1½ grinds accurately, gives a fine finish, and is recommended for the finest types of flat, form, and gage grinding. It is a hand feed grinder designed to handle the large number of jobs which consist of one piece only and for which no mechanic will bother to adjust automatic feeds and stops. It has an unusual capacity, handling work 15″ long x 10″ wide x 12″ high.

FEATURES

Built-in motor, an integral part of head; hand feeds, eliminate many moving parts; hand wheels of good size, conveniently located; vertical adjustment rapid and sensitive; wearing surfaces easily lubricated.

The No. 1½ Grinder illustrated; and the Abrasive fully automatic grinders—No. 3B with horizontal spindle and No. 34 with vertical spindle—are described in Sweet's Catalog, or in more detail in separate bulletins available from any dealer listed below.

ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE, RHODE ISLAND, U. S. A.

WRITE OR PHONE NEAREST DEALER

HOME OFFICE
East Providence . . . East Prov. 0549

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RUSSELL, HOLBROOK & HENDERSON, INC.
New York, N. Y. . . . Walker 5-6751

C. H. BRIGGS MACHINE TOOL CO.
Syracuse . . . . . Syracuse 2-4905

THE GEORGE KELLER MACHINERY CO.
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SWIND MACHINERY CO.
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Baltimore ..... Tuxedo 0104
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THE MOTCH & MERRY-WEATHER MACHINERY CO.
Cleveland ..... Main 1000
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MARSHALL & HUSCHART MACHINERY CO.
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BLACKMAN & NUETZEL MACH. CO., INC.
St. Louis ..... Newstead 0765

TIDEWATER SUPPLY CO., INC.
Norfolk 27311
Asheville 376
Columbia 8169

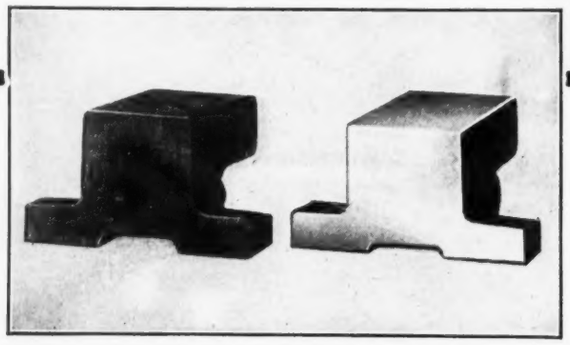
W. S. MURIAN CO.
Knoxville ..... Knoxville 3-4331

HENES-MORGAN MACHINERY CO. LTD.
Los Angeles ..... Jefferson 7185

JENISON MACHINERY CO.
San Francisco ..... Valenia 1710

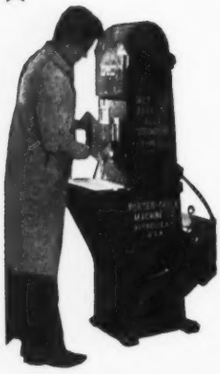
When It Must Be

★ 1. DEAD FLAT
★ 2. EXACTLY SQUARED
★ 3. GLASS SMOOTH



THIS PORTER-CABLE WET-DRY SURFACER

Will Do it to Finer Limits . . . FASTER!



What would it cost you to do this job on your milling machine? . . . an actual production job turned out in jig time on a PORTER-CABLE WET-DRY SURFACER. The specifications say it must square true to 90°, with both surfaces finished dead flat and glass smooth. Yet operators of average skill have no trouble in meeting the specifications. The speed they maintain makes it a big saving to do the operation on the WET-DRY SURFACER.

★ PORTER-CABLE WET-DRY SURFACERS are relieving the pressure on millers, shapers and planers in scores of plants. Much of the work is done free hand, though for close limits up to .0005", simple fixtures are used.

★ Various models of the WET-DRY SURFACER are readily adaptable to many secondary operations such as burring, finning, finishing, cutting radii and the like.

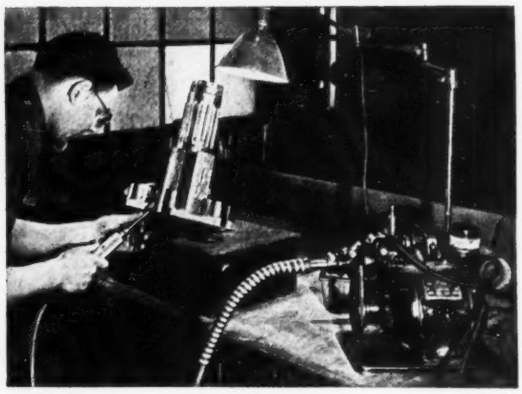
★ Production men find them especially valuable where work must be fitted to the capabilities of women and unskilled workers, because their simplicity of operation insures speed, accuracy and safety.

★ Learn about this new machining method that's a revelation in many shops—the new, low-cost way to increase production and relieve overburdened major machine tools. Write TODAY for copy of Free booklet, "Wet-Dry Belt Surfacing," without obligation.

PORTER-CABLE MACHINE CO.
1801-2 N. Salina Street,
Syracuse, N. Y.

FOR ACCURATE AIRCRAFT WORK

In Hard-to-get-at Places

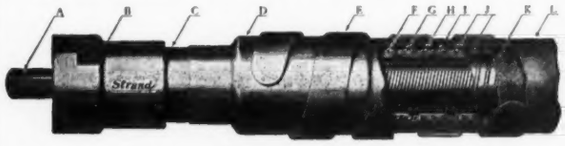


For accurate grinding and polishing in hard-to-get-at places on "Whirlwind" and "Cyclone" Engines, the Wright Aeronautical Corp. has forty Strand Machines.

There's plenty of work for Strands in aircraft manufacture, where a wide variety of jobs on intricate motor parts all require accurate finishing. Strands can be used for grinding, polishing, buffing, sanding, drilling, reaming, nut setting — wherever a convenient, portable source of rotary power is needed. Write for further details of Strand applications in all industries.

DETAILS OF STRAND CONSTRUCTION

A—Core End. B—Swivel Coupling Nut. C—Tail Piece for Coupling Nut. D—Ferrule. E—Steel Reinforcement. F—Inside Liner. G—Wire Core Shaft. H—Asbestos Packing. I—Stop Wire. J—Metal Tubing Interlocking Joints. K—Metal Braiding. L—Vulcanized Rubber and Canvas Cover.

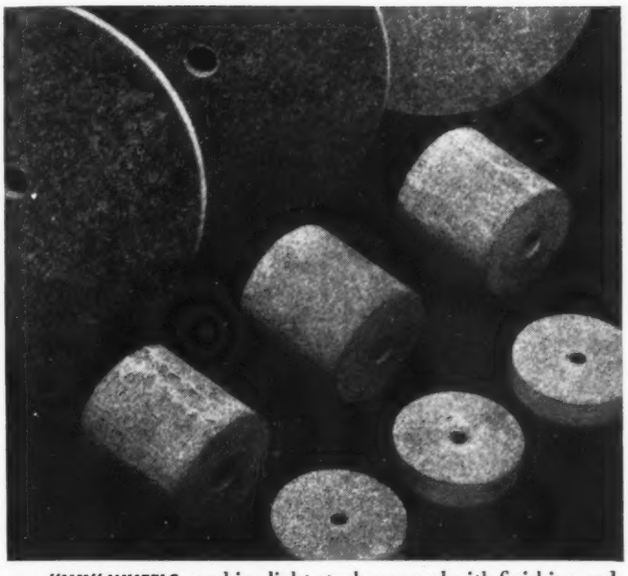


N. A. STRAND & COMPANY
5001 No. Wolcott Ave. CHICAGO, ILL.

Strand
FLEXIBLE SHAFTS

3 NEW WAYS

to speed output . . .



1 **"MX" WHEELS** combine light stock removal with finishing and polishing action. They are free-cutting and are to be used dry on any portable machine. For breaking down sharp edges on gears etc., finishing and polishing out-of-the-way places.

CARBORUNDUM PRESENTS 3 NEW "WEAPONS FOR PRODUCTION"

KEEPING pace with the war program, Carborundum has developed many new and novel coated abrasive products—Weapons for Production to speed output, insure high finishes and lower costs. Here are three of the most versatile and useful! They are particularly adapted for finishing and polishing out-of-the-way places on airplane engine parts and similar metal work.

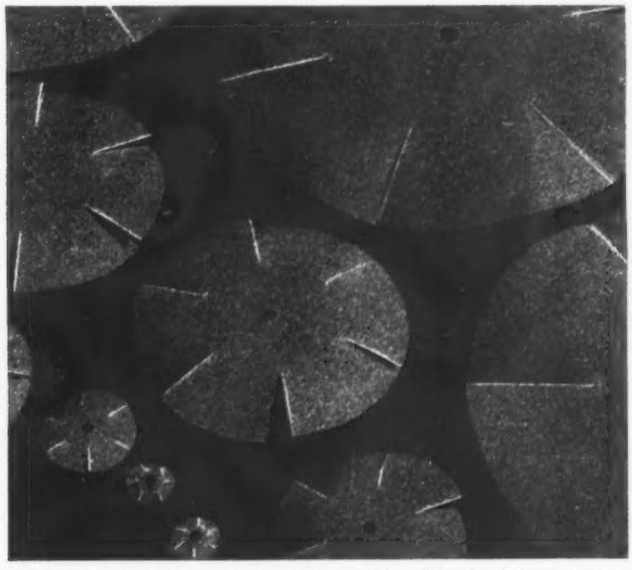
1. ***"MX" Wheels*** are fabricated from cotton fibres intimately intermingled with Aloxite Brand Aluminum Oxide or Carborundum Brand Silicon Carbide grain. They are made in six grades of hardness.

2. ***Cloth Cartridge Rolls*** are made in diameters from $\frac{3}{8}$ to 1 inch of tightly wound, glued strips of metal working abrasive cloth. Rolls are from 1 to 3 inches in length.

3. ***Multi-Slotted Discs*** afford a time-saving, cost-saving way to burr and polish the edges of holes in metal work. Produced in all necessary grits, in diameters from $\frac{1}{2}$ to 6 in.

CARBORUNDUM
ABRASIVE PRODUCTS

2 **CLOTH CARTRIDGE ROLLS** can be mounted on a spindle and used on a portable tool for finishing hard-to-reach surfaces. As abrasive surface wears down, cloth backing can be torn off to expose fresh layer of abrasive.



3 **MULTI-SLOTTED ABRASIVE DISCS** simplify the job of removing the burr and producing the true radius required on holes. Used in a portable power tool, the disc "cones" backward, finishing only the hole edge. When two discs are mounted together back to back, they can be used to finish both edges.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks and MX is a trade-mark of, and indicate manufacture by The Carborundum Company)

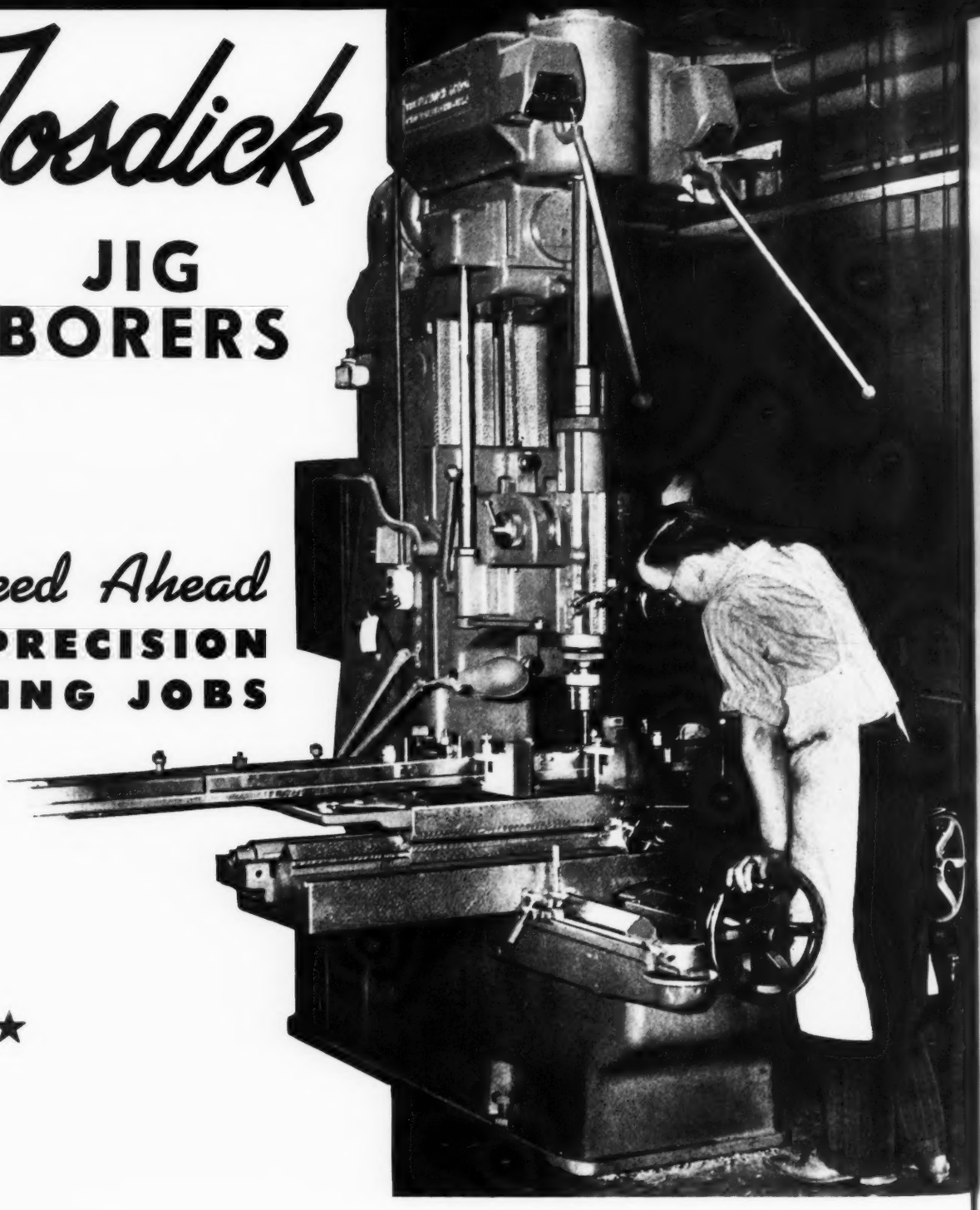
Fosdick

JIG BORERS

FOR

Full Speed Ahead

ON PRECISION BORING JOBS



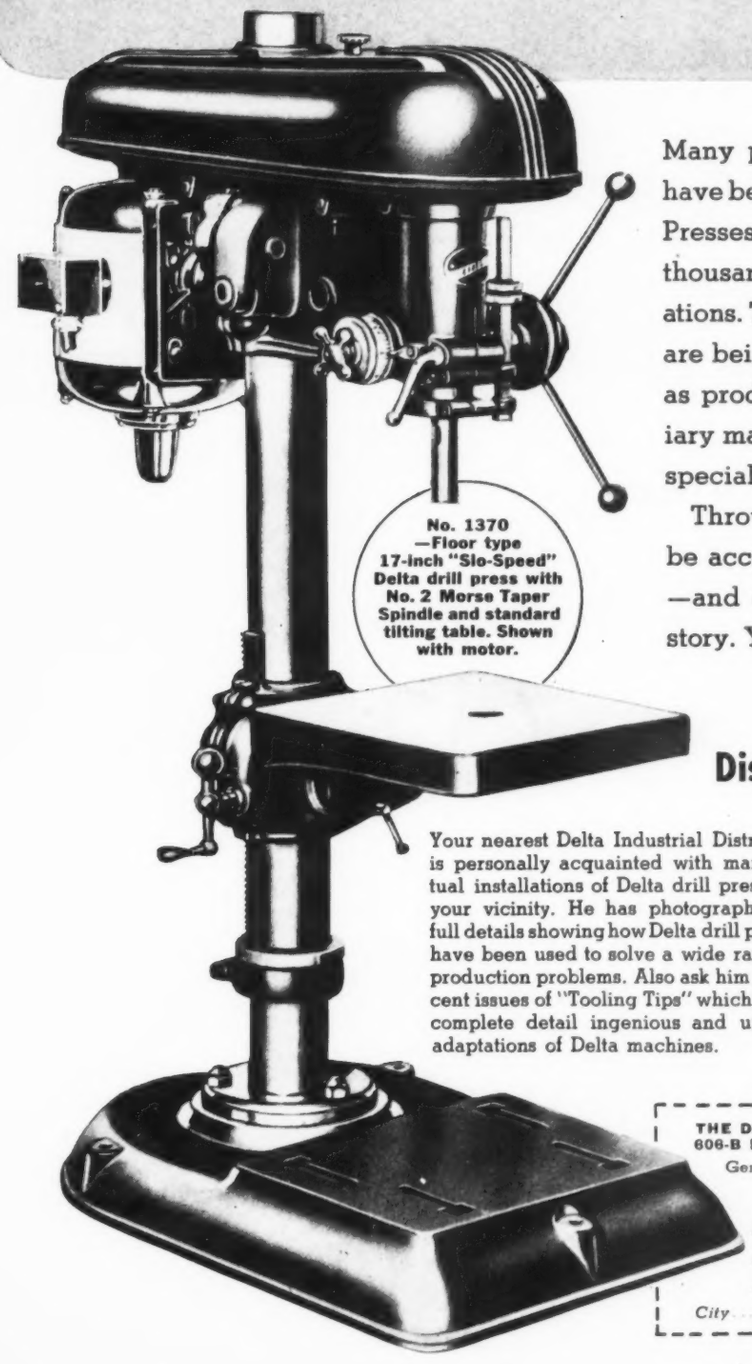
★

When the Navy calls for planes, "Full Speed Ahead" is the order! At a plant of the Curtiss-Wright Corporation engaged in building Navy planes, Fosdick Jig Borers are helping to meet the double-barreled demand for **precision** boring at **high speeds.** Above is a Fosdick Jig Borer pictured boring bushing holes in a drill jig. Curtiss-Wright has also discovered that the Fosdick Jig Borer can do milling work, saving time over the slower, less satisfactory "button" method of cutting irregularly-shaped borings. An ordinary drill is used to start the work, after which the borer is brought into play. On many jobs of this nature, the Fosdick Jig Borer is enabling Curtiss-Wright to bore within a half-thousandth.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ... OHIO

How to Solve Production Problems

with Delta Low-Cost DRILL PRESSES



No. 1370 —Floor type 17-inch "Slo-Speed" Delta drill press with No. 2 Morse Taper Spindle and standard tilting table. Shown with motor.

Many problems that stump production men have been successfully solved with Delta Drill Presses. This has been definitely proven in thousands of cases—on a large variety of operations. Today, these efficient, flexible machines are being used in thousands of plants not only as production line equipment—but as auxiliary machines, special purpose machines, for special set-ups and tool room equipment.

Throw overboard your notions of what can be accomplished with standard drill presses —and get the full details of this remarkable story. You will be in for a distinct surprise!

Ask your Delta Industrial Distributor for Full Details

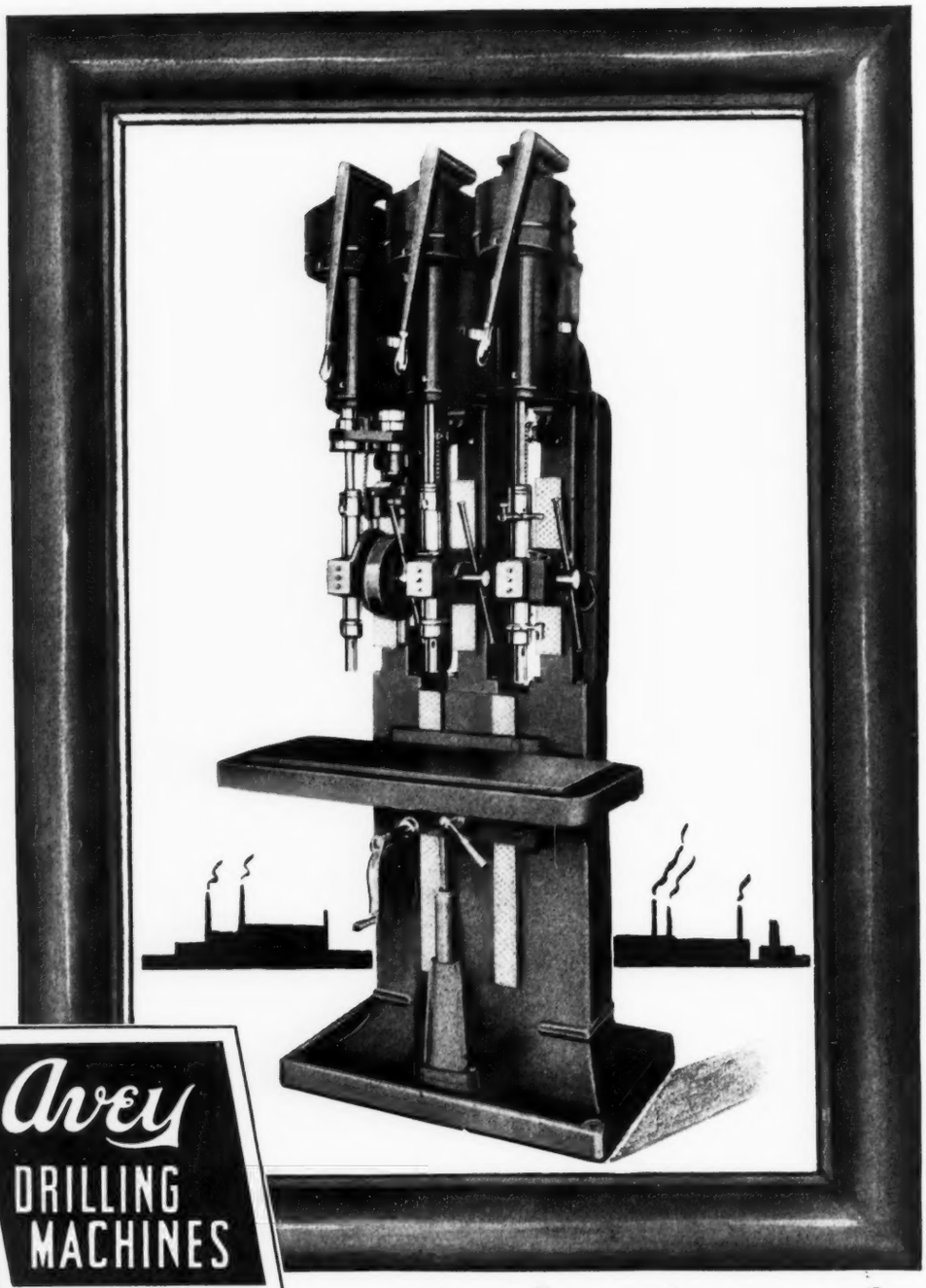
Your nearest Delta Industrial Distributor is personally acquainted with many actual installations of Delta drill presses in your vicinity. He has photographs and full details showing how Delta drill presses have been used to solve a wide range of production problems. Also ask him for recent issues of "Tooling Tips" which tell in complete detail ingenious and unusual adaptations of Delta machines.

DELTA
MILWAUKEE

THE DELTA MANUFACTURING COMPANY
606-B E. Vienna Avenue, Milwaukee, Wis.

Gentlemen: ☐ Send me name and address of Delta Industrial Distributor in my locality.
☐ I want to receive "Tooling Tips" as issued.

Name .....
Address .....
Firm .....
City ..... *State* .....



Avey
DRILLING
MACHINES

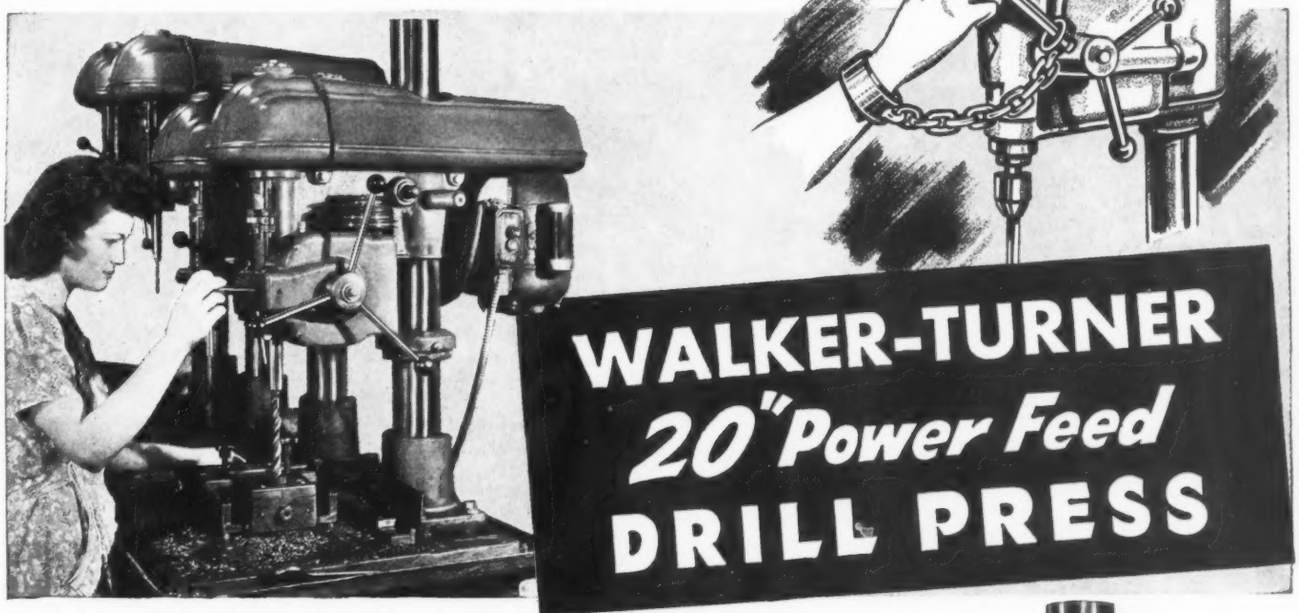
. . . in the picture for 1943

Make sure it is in your production line for 1943. Avey Drilling Machines give longer operating hours, smoother performance and lower maintenance. They'll do your war job now, your peace job later. We illustrate the Avey Type MA-6 in No. 2 size (*Capacity in cast iron, 7/8"*). No. 3 size (*Capacity in cast iron, 1 1/4"*). One to six spindle units, either size. Six speed machine, two speed motor, three mechanical changes through gearing, 8 to 1 speed range. Push button control. MA-6 illustrated, has three spindles, the Aveymatic Feed, Hand Feed and Tapper.

AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO U. S. A.

Avey DRILLING MACHINES
CINCINNATI · OHIO

TAKE THE HANDCUFFS OFF YOUR DRILL PRESS OPERATORS!



WALKER-TURNER 20" Power Feed DRILL PRESS

Don't handcuff your operators by making them bear down on the feed levers of hand-feed drill presses. The new Walker-Turner 20" Power Feed Drill Press is ideal for production drilling operations because:

1) **It is designed to standards of accuracy found heretofore only in much higher priced machines.**
2) **Large scale production methods make possible its low price ($255 up).**
3) **It is obtainable in multiple spindle models, up to six spindles.**
4) **Simple, streamlined design makes it easy for unskilled labor to operate with very little instruction.**
5) **It handles all of the usual drill press operations, drilling, reaming, tapping and counterboring.**

Write for literature and prices:
Walker-Turner Company, Inc.,
1823 Berckman Street, Plainfield, N. J.

SPECIFICATIONS

CAPACITY: Drills to center of 20" circle. Feed 6". Drills up to 1" in cast iron, ¾" in steel. Feeding speeds, .003", .006", .009", .012" per spindle revolution. Spindle speeds, 260-5200 r.p.m.

One piece head casting, line bored. Ten spline spindle, with four precision ball bearings. Pulley mounted between two ball bearings to prevent whip. One shot lubrication. No. 2 Morse Taper. Many other features.

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

WALKER-TURNER MACHINE TOOLS
FOR METAL, WOOD AND PLASTICS

DRILL PRESSES · BAND SAWS · BENCH SAWS · TILTING ARBOR SAWS · LATHES
JIG SAWS · RADIAL SAWS · RADIAL DRILLS · BELT AND DISC SURFACERS · JOINTERS
SPINDLE SHAPERS · GRINDERS · FLEXIBLE SHAFT MACHINES · CUSTOM BUILT MOTORS

6 NEW BOOKS FOR THOSE INTERESTED IN PRECISION TAPPING

★ *Send for your copy without obligation*

NO. 1

NO. 1-R

NO. 2

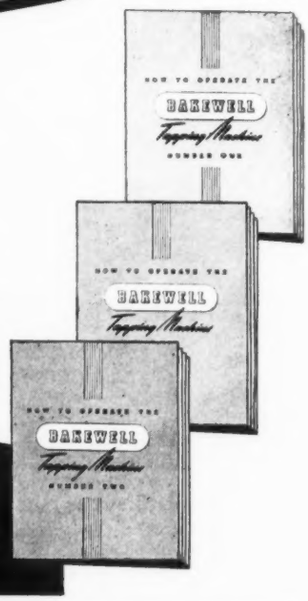
If your problem is to get Class 3 or 4 gage fits tapped in any kind of material on a speedy war production basis, then you'll want one of these factual books.

The three catalogs describe three Bakewell Precision Tapping Machines: the No. 1 with capacities of 4-40 to ⅝″ in steels, the 1-R, Radial, for the same size holes in large and bulky pieces of work and the No. 2 for tapping holes from ⅜ to 1½″ in steels.

The other books are primarily for Bakewell owners—operators' manuals that give informative data for getting the most out of your machine.

Any or all of these books are yours for the asking. Send today for the copies which interest you.

★ PROMPT DELIVERIES ON ALL MODELS



BAKEWELL MANUFACTURING CO.

2023 SANTA FE AVENUE • LOS ANGELES, CALIFORNIA

How to step up your TAPPING OUTPUT

Hundreds of users of Procunier Tapping Machines (names on request) will give you day-by-day figures proving that these machines definitely speed up tapping operations, do more accurate work and reduce tap breakage. There are specific reasons for this superior performance of Procunier Machines: 1. The improved Procunier tapping head with double-cone cork-face friction clutch and other exclusive features; 2. Four speeds, ranging from 390 to 2050 RPM efficiently handle jobs for which conventional high speed tapping machines are inadequate; 3. One machine handles tap sizes from No. 2 to ½″ through two interchangeable heads; 4. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR.

Tap Establishes its own Lead!

The new Procunier Universal Tapping Machine is exclusively designed so that it actually allows the tap to establish its own lead. There is nothing more accurate than a precision ground thread tap as a guide for tapping—so maximum tapping efficiency is attained where an accurate tap is free to establish its own lead in cutting the thread.

PROCUNIER SAFETY CHUCK COMPANY

16 S. Clinton Street, Chicago

SEND FOR CATALOG

giving full details, description and prices on the full line of Procunier Universal Tapping Machines, hand or foot operated, the complete line of Procunier Precision Tapping Heads to meet all needs and the new Tru-Grip Tap Holder.

PROCUNIER SAFETY CHUCK COMPANY
16 S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name .....

Address .....

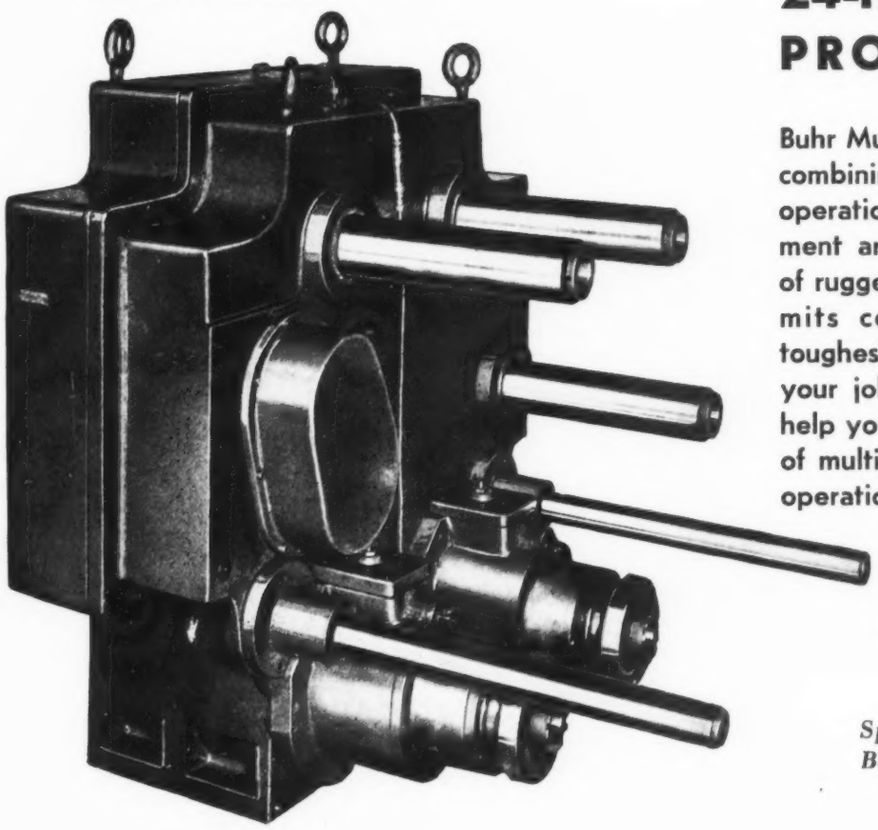
City ..... State .....

28-Spindle Buhr Indexing Drilling and Reaming Head. Vertical adjustment in spindles to lengthen drills. Group of ten spindles indexes eighteen degrees to countersink holes in mating part.

IF IT'S A Buhr

MULTIPLE PRODUCTION DRILL HEAD

Buhr 5-Spindle Horizontal Heavy Duty Drill Head—1/8" high—vertical adjustment in all spindles—oil pump lubrication—for 2-way machine, facing, boring and hollow-milling holes in axle housings.

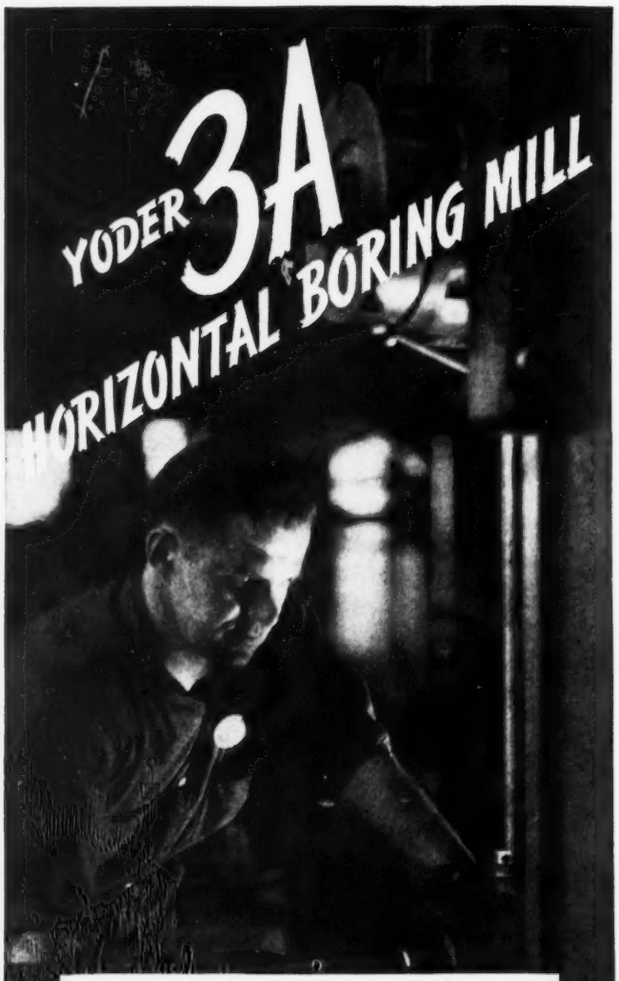


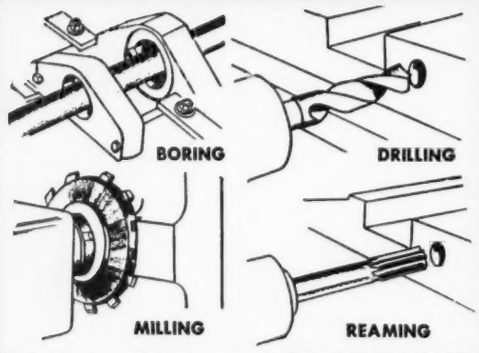
IT'S GOOD FOR 24-HOUR-A-DAY PRODUCTION!

Buhr Multiple Production Drill Heads are combining, speeding-up and simplifying operations . . . and users of Buhr equipment are getting the added advantage of rugged construction, stamina that permits continuous operation on the toughest wartime jobs. Send details of your jobs to Buhr engineers. They can help you speed up and simplify all kinds of multiple drilling, boring and reaming operations.

BUHR MACHINE TOOL COMPANY
ANN ARBOR, MICH.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment





Add the advantages of POWER TOUCH CONTROL and POWER FLOW DRIVE to the other exclusive advantages of the YODER 3A HORIZONTAL BORING MILL. These make it the newest, most flexible and soundly engineered of this popular type of multi-purpose machine tool.
War production now . . . . postwar production eventually, will make a Yoder 3A Horizontal Boring Mill a MUST as a general utility tool in a large majority of machine shops.
Reasonable delivery dates are again possible. Let us hear from you. We have a bulletin.

The ENGINEERING YODER MANUFACTURING SALES COMPANY
Cleveland, Ohio, U. S. A.

MARK IT BEST with NOBLEWEST

Step up the speed of your marking operations with Noblewest precision built marking equipment. You will be certain of sharper, clearer, lasting impressions whatever the size — whatever the shape of the item to be marked. Find out how Noblewest marking machines can be adapted to meet your individual requirements. Write for our new catalog supplement No. 43 — "Your Guide To Better, Faster, Marking."

NOBLE & WESTBROOK MANUFACTURING CO.
Marking Specialists Since 1904
East Hartford - Conn.

MARK IT BEST WITH NOBLEWEST® NOBLEWEST IMPROVED MARKING DEVICES

FLEXIBLE SHAFT MACHINES WILL DO IT QUICKER...BETTER

. . . and Haskins will do it *LONGER!*

HASKINS Flexible Shaft Equipment is built to give long, trouble-free operation. To handle easier. To give you more production per man and machine hour. There are 30 models for every shop requirement. Catalog 45 shows many ways to speed production with Haskins Equipment. Write for a copy. R. G. Haskins Company, 617 S. California Avenue, Chicago.

HASKINS

HASKINS Versatile FLEXIBLE SHAFT EQUIPMENT

IN PRODUCTION AS IN BATTLE

It's the Result that counts!

YOU DEMANDED IT . . . . WE MET YOUR DEMANDS

YOU wanted an 18″ Duro Drill Press, Easy and Simple of Operation.

YOU wanted Ruggedness to stand constant service, also ¾″ drilling capacity.

YOU wanted weight, flexibility and smoothness of power to give vibrationless performance.

WE have met all your wishes in this new massive 18″ Duro Drill Press and we know the results will satisfy your most exacting demands.

DURO METAL PRODUCTS CO.
2649 North Kildare Avenue
CHICAGO - - - - ILLINOIS

DURO FOR DURABILITY

36 HOLES in Propeller Blade Bushing *held to* ACCURACY *of* ±.0005″ *with* HIGH FINISH

(Above) All dimensions in finish boring the 36 high-finish holes in these Bronze Propeller Blade Bushings are held to ±.0005″.

STOKERUNIT SIMPLEX PRECISION BORING MACHINE

Precision Bores Each Hole in 16 Seconds

A widely known manufacturer of airplane propeller parts is regularly using a battery of Stokerunit Simplex Precision Boring Machines to insure superior finish and precision accuracy in critical boring operations.

In the production of these alloy bronze propeller blade bushings, for example, an extremely fine finish with close tolerances is required in finish boring the 36 holes in the flange. All dimensions—roundness of hole, dimensions between holes and distance from center of bushing—are uniformly held to ±.0005″.

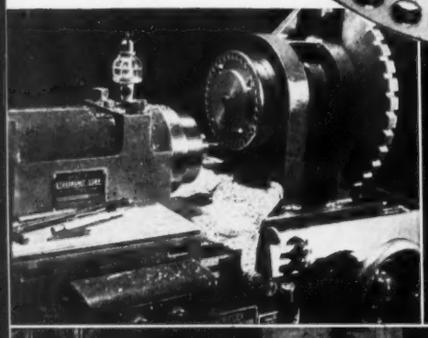
PRECISION ACCURACY AND FINE FINISH MAINTAINED IN PRODUCTION

In this setup, the Stokerunit Simplex Precision Boring Machine bores one hole at a time every 16 seconds in alloy bronze bushings—hardness 90-100 Rockwell. Hole is .3125″ in dia. ±.0005″ by 1/4″ deep. Work slide is equipped with constant reciprocating feed, and indexing is done by hand when work is clear of tool. Feed is 4 7/8″ per minute; spindle speed 1750 r.p.m. Every rigid requirement of accuracy and finish is consistently maintained.

VERSATILITY—Stokerunit Simplex Precision Boring Machines can be adapted to a multiplicity of precision boring operations—for either short-run or production work. They can be furnished with single or multiple spindles, depending upon your requirements. Over 25 models are available in both mechanical and hydraulic feeds and cover practically the entire range of precision boring applications.

Profit with precision accuracy, finer finish and increased production in your precision boring operations. Consult our engineers for a study of your parts and production problems.

For specific recommendations, send blueprints of parts with production requirements. No obligation.



(Left) One hole at a time is precision bored every 16 seconds.

(Right) The Simplex maintains precision accuracy and fine finish in production.

(Below) Partial view of battery of Stokerunit Simplex Precision Boring Machines in plant producing airplane propeller parts.

BULLETINS with Complete Data!

Write today for these two booklets covering our entire line of Simplex Precision Boring Machines. Full details and specifications of each type are included.

STOKERUNIT CORPORATION

DESIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACHINES

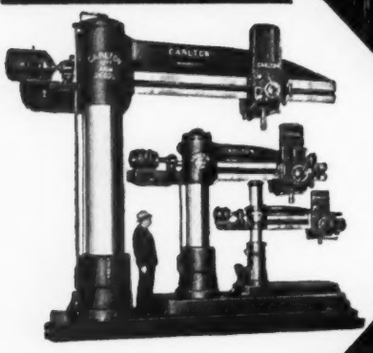
4526 WEST MITCHELL STREET · MILWAUKEE, WISCONSIN

This Simplex Shell Centering Machine, built by the Stokerunit Corporation of Milwaukee, is equipped with a Model "HR" "LOGAN" Hydraulic Cylinder and a "LOGAN" Expanding Mandrel. Model "HR" "LOGAN" double acting, rotating type Hydraulic Cylinders are designed for the efficient operation of all chucks, mandrels and other work holding devices required to be mounted on rotating spindles. The 6-Jaw "LOGAN" Expanding Mandrel holds the shell securely in place during the work operation. "LOGAN" Hydraulic Equipment provides rapid, positive action and rigid support of work. Let "LOGAN" Representatives and Engineers make recommendations on your hydraulic problems.

★ **LOGANSPORT MACHINE, INCORPORATED** ★

910 PAYSON ROAD LOGANSPORT, INDIANA

Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories

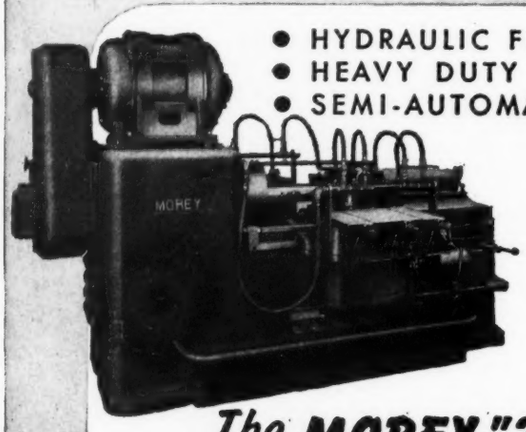


CARLTON RADIALS

» Carlton Radial Drilling Machines are in use in many of the United States Naval Yards throughout the country. They are also being used by the regular commercial ship builders and by sub-contractors such as—steel mills, the large electrical companies, and others supplying materials for the construction of ships.

THE CARLTON MACHINE TOOL CO., Cincinnati, O.

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

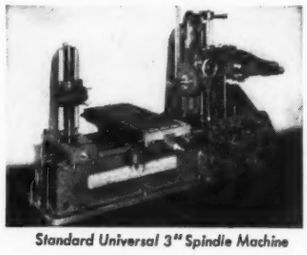
Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

UNIVERSAL *Horizontal Boring Machine*
The only **TRIWAY** *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.
CLEVELAND, OHIO, U. S. A.
NOW AND ALWAYS OF

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.

COLBORNE Speed Lathes

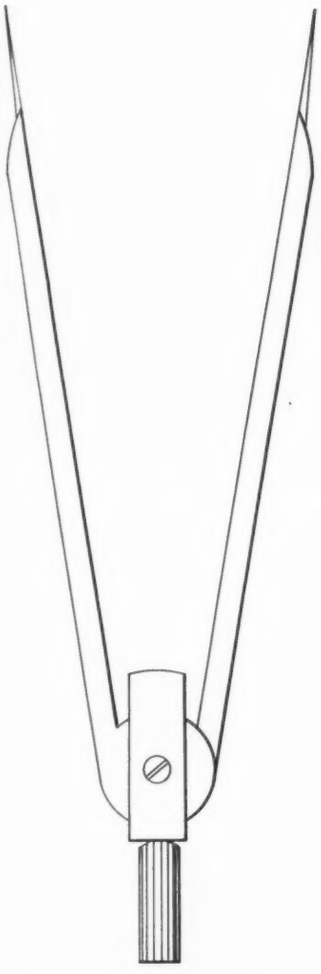
SPEED UP FINAL OPERATIONS ON DIES . . . GEARS . . . SCREWS LONG RODS . . . SMALL PARTS

For economical polishing, burring, lapping or finishing of gears, dies, gages, ball races, long rods, small parts, etc.

Built to meet the requirements of those desiring a heavily constructed, smooth running machine of highest quality . . . Has built-in motor with variable speed control, using REEVES standard pulley and belt . . . Smooth automatic brake acts instantly when switch is thrown . . . Collets or chuck may be used.

PROMPT DELIVERY! WRITE TODAY FOR DETAILS

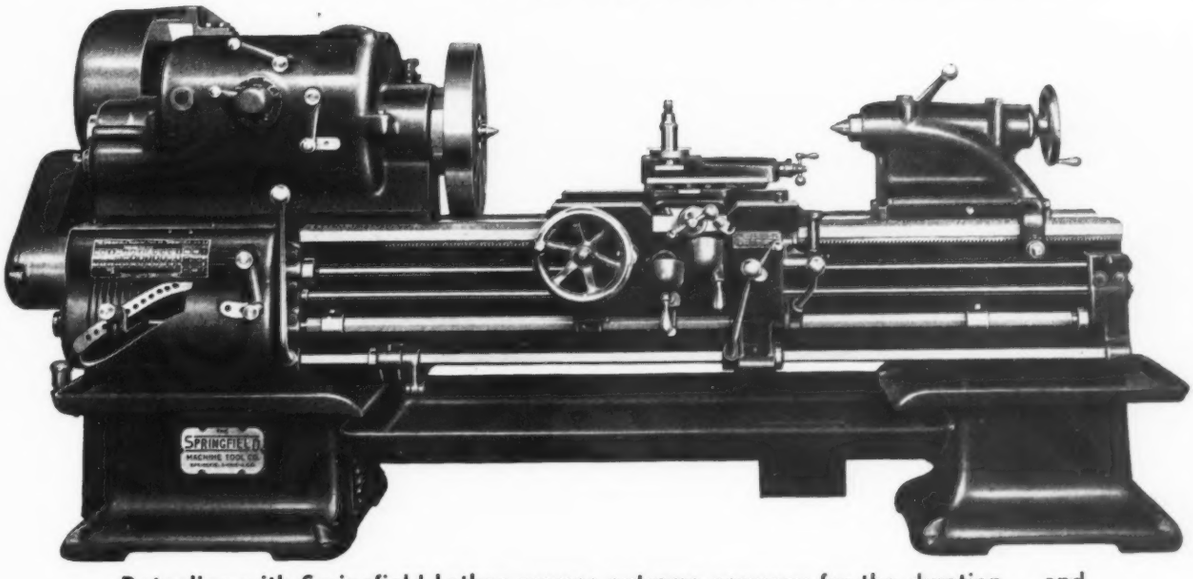
COLBORNE MANUFACTURING COMPANY
155 W. Division Street Machinery builders since 1879 **Chicago, Ill.**



ICTORY through Precision

The thorough care in design and construction of the Springfield Lathe is directly responsible for the Precision it maintains for long shifts of uninterrupted service. Largely responsible for its excellent performance are the following valuable features, many of them exclusive to Springfield: All lead screws of high carbon steels, tested to .001" to the foot—used for thread chasing only; feed rod is supplied for all feeds. Chrome Molybdenum hardened and lapped gears with rounded teeth in sturdy headstock. Back gear clutch splined on spindle and into face gear and cone sleeve. All drive shafts and main drive splined and mounted on ball bearings. Semi-steel apron, with vital dimensions in excess of ordinary models. High test nickel chrome gray iron Bed, the result of exhaustive metallurgical tests, guaranteed to give great wear-resistance, with no internal strains, protected against scoring, warping, marring. Springfield Lathes assure finest performance possible, a valuable contribution to Victory production.

SPRINGFIELD



Retooling with Springfield Lathes assures extreme accuracy for the duration . . and the maintenance of such accuracy for a long, profitable life thereafter

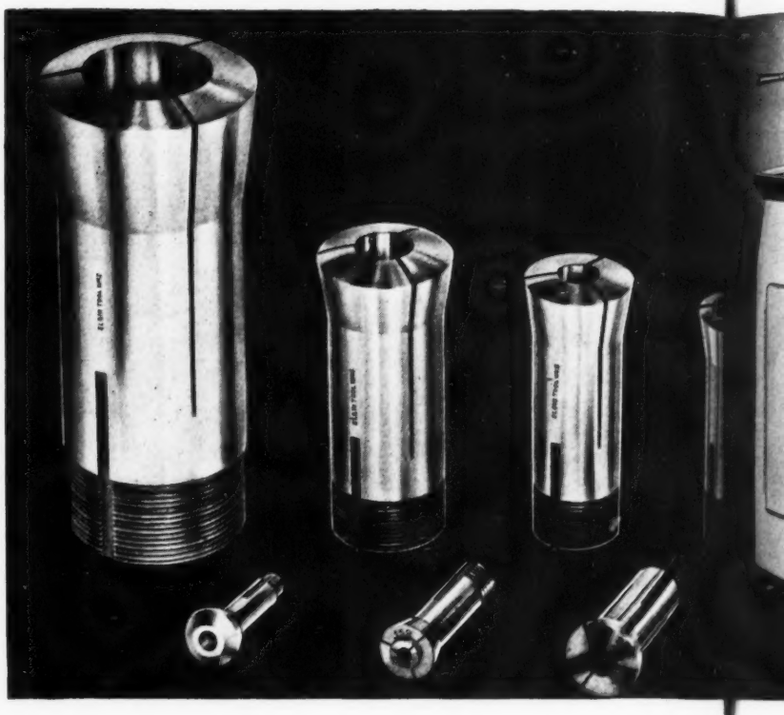
SEND TODAY FOR BULLETIN NO. 162

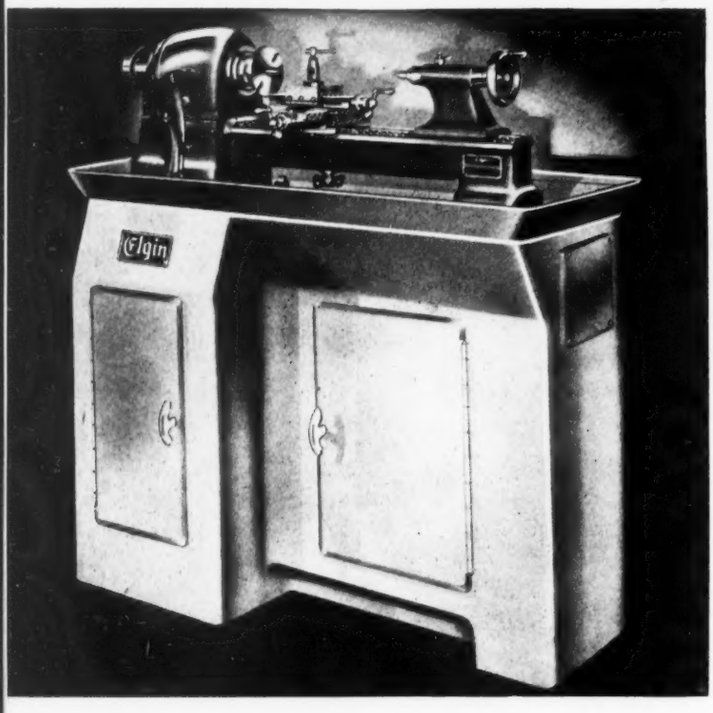
THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD, OHIO

Elgin

TOOLS ASSURE ON EXACTING WAR

At right: Elgin Collets in all standard and special types, in any size for your work. Directly below: Elgin Lathe on pedestal base. Up to 1" collet capacity. Up to 9" swing, 17" between centers. Below: Elgin Horizontal Milling Machine. Table 4 1/8" x 18". Longitudinal table travel 6", transverse 6".



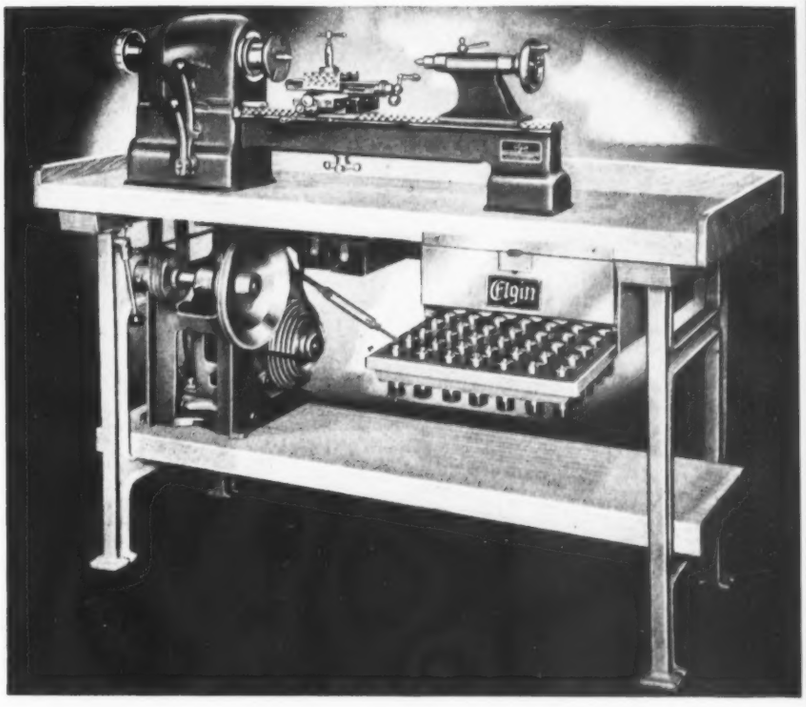


There is hardly an item of war equipment being machined today that does not require, at some point in its manufacture, an operation to an exceptionally high degree of precision. Standards are especially high in making gun and bomb sights, range finders, aircraft and similar instruments, and it is in producing small parts for these important war essentials that Elgin Bench Lathes, Screw Machines and Milling Machines are

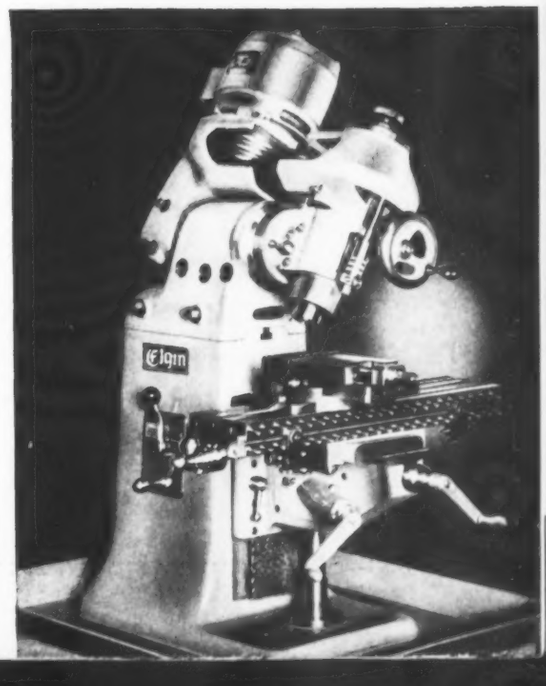
ELGIN TOOL WORKS

Precision RESULTS PRODUCTION JOBS

At left: Elgin Hand Screw Machine on pedestal base, available in sizes up to 1" collet capacity, 9" swing. Directly below: Elgin Bench Lathe, available in sizes up to 1" collet capacity. Shown mounted on maple bench top 60" x 30". Below: Elgin Vertical Milling Machine. 1.70" vertical spindle travel. 90° swivel each side of center line.



proving their precision and their production capacity. The Machines and collets illustrated have been developed to deliver smooth, trouble-free performance, high-speed operation and —above all—precision of the highest order on exacting wartime toolroom and production jobs. Let us send you full details of the Elgin machines and collets illustrated and tell you how they can help to speed your production for Victory.



1770 BERTEAU AVE., CHICAGO, ILL.

THE BRADFORD *Metalmaster*

OFFERS THESE NOTES TO AID YOU IN

Efficient Lathe Operation

• A level lathe insures precision accuracy of work. When installing a lathe, use a precision level that will show errors of at least .003 inches per foot. Check the leveling of the lathe after bolting it to floor or bench.

• Always make sure the spindle tapers of the lathe are clean and free from burrs before inserting the lathe centers.

• If the face plate or chuck does not run true, examine the shoulder of the lathe spindle and face of hub on face plate or chuck back for burrs, dirt, etc.

• Always clean and oil the threads before screwing a chuck or face plate onto the lathe spindle—And don't forget that a surface polished with oil will keep clean longer, and operate more efficiently, than one polished dry.

• The Metalmaster's advanced design and Bradford's skill in manufacture combine to offer you the ultimate in precision operation. Write today for details—we'll gladly send complete catalogs.

THE BRADFORD MACHINE TOOL CO.

671 Evans St., Cincinnati, Ohio

1840 **1943**

WEAPONS TODAY... TOOLS TOMORROW

The production demands of war have brought home the fact that machine tools are playing a highly important part as war-winning weapons. Every usable machine tool has now been placed in hard and constant service. Where once lathes turned eight hours a day, forty hours a week, they must now turn twenty-four hours every day—a hundred and sixty-eight hours every week—more than four times as long as what was once considered normal.

This long and heavy service, coupled with the fact that the shortage of skilled man-power has necessitated the use, in many cases, of inexperienced and untrained workers, means that the normally expected service life of the average machine tool will be decreased proportionately.

Fifty years of manufacturing experience, twenty-five of which have been devoted to the production and development of heavy duty engine lathes, have taught far-sighted Axelson engineers the facts about extra service demands on machine tools.

Built-in quality, designed to take hard and constant service, keeps Axelson lathes turning to close-tolerance accuracy year after year, successfully handling the toughest jobs in top production war plants throughout the United Nations.

Yes, all machine tools are vital weapons today, and through their use American industry, backing our fighting men, will win the final Victory. But after it's over your Axelson Lathe will still be accurately turning out peace-time products for years to come—helping to build a new world of freedom and liberty for all

AXELSON MANUFACTURING COMPANY

6160 SO. BOYLE AVE. (P. O. Box 98, Vernon Station), LOS ANGELES, CALIF.

50 Church St., New York • 3844 Walsh St., St. Louis • 204 Munsey Bldg., Washington, D. C.

CABLE ADDRESS: "AXELSON"

AXELSON 50th YEAR 1892 1942

BEFORE YOU BUY ANY LATHE INVESTIGATE *AXELSON*

GET MUCH-NEEDED *Extra* CAPACITY *with* JEFFERSON TURRETS

Meet the demands of wartime production by equipping your lathes with Jefferson Turrets! Attached with an ordinary wrench, they are giving extra capacity, quickly and at low cost.

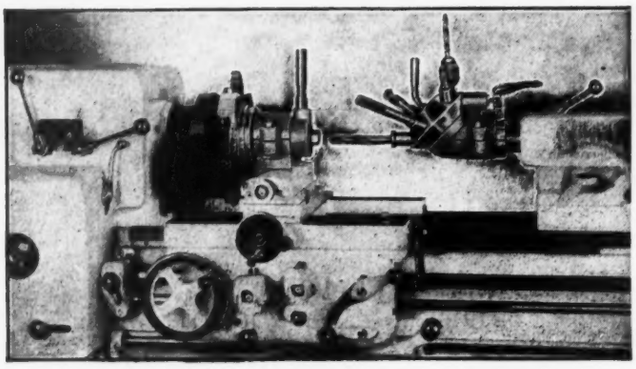
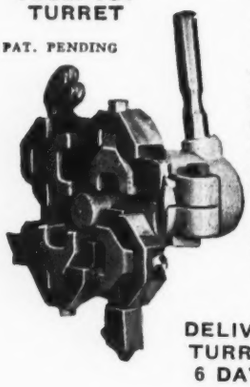


PHOTO SHOWS TURRETS APPLIED TO 16" LATHE

4-TOOL TOOLPOST TURRET

PAT. PENDING



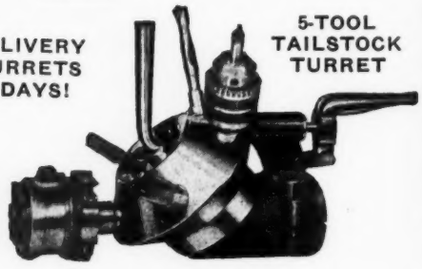
TOOLPOST TURRET (left) mounted on cross slide or compound rest. Carries four separate tools, multiplying the capacity of your toolpost! Made in two sizes for standard 0, 00, 1, and 2 tool holders.

TAILSTOCK TURRET (below) holds five tools, each centering automatically when brought into position. Made in four sizes for all lathes from small bench sizes up to those with 24" swing.

Also, the **ADJUSTABLE PULL FEED** to eliminate usual slow hand-wheel method.

DELIVERY TURRETS 6 DAYS!

5-TOOL TAILSTOCK TURRET



JEFFERSON No. 101 SWING FRAME GRINDING and POLISHING MACHINE

For wheels up to 14" dia. Can be swung full universal: forward, backward, up, down, right, left, at any desired angle. Does the work of two men.

DELIVERY 20 DAYS

Write for Bulletin TD—showing Jefferson Turret Attachments, Milling Machines, Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Foundry Riddles.

JEFFERSON MACHINE TOOL CO.

673-773 W. Fourth St., Cincinnati, Ohio

KEYSEATING (and other jobs) AT WARTIME SPEED!

Plants engaged in war production are keeping Davis Keyseaters busy on a variety of jobs. The tilting table, high capacity, and quick set-up features make them extremely versatile, useful for many jobs in addition to keyseating. And the Davis broaching pull cut saves time on every job! Write for full details.

DAVIS KEYSEATER CO.

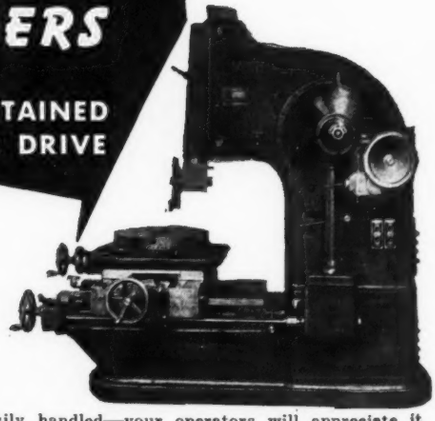
405 Exchange St., ROCHESTER, N. Y.

Accurate, High-Speed

MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE
14" STROKE

SELF-CONTAINED MOTOR DRIVE



FEATURES

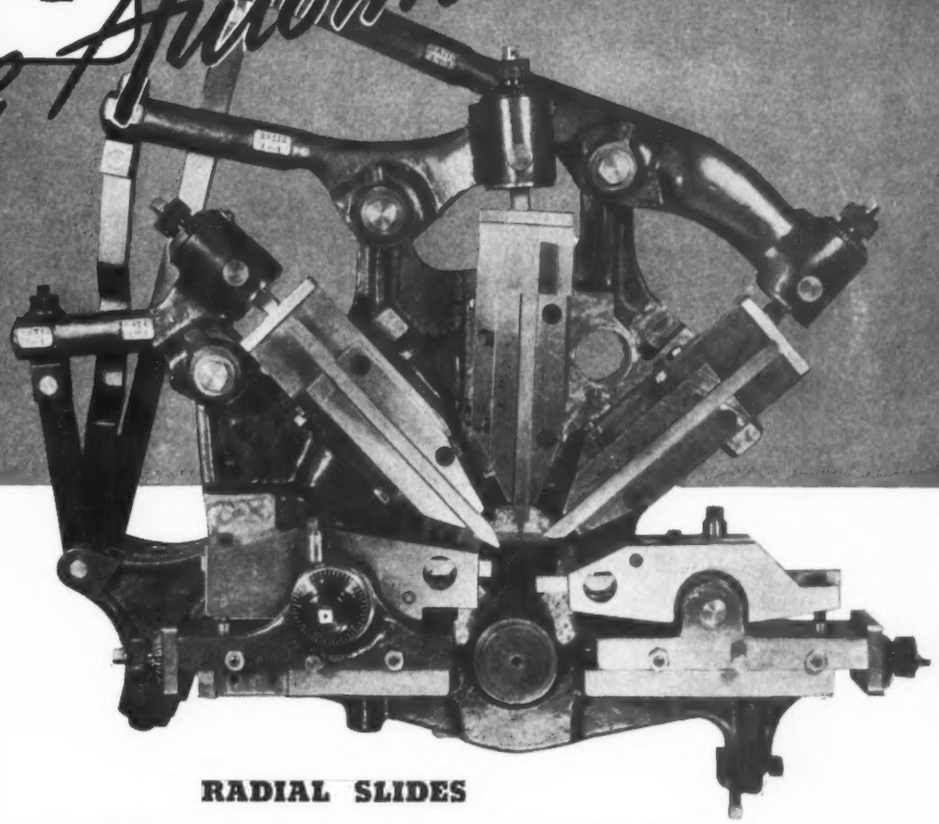
Precision . . . Easily handled—your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control . . .

ASK FOR CIRCULAR 726

MOREY MACHINERY CO., INC.

410 Broome Street New York, N. Y.

CECO *Swiss Type Automatics*



Here are a few pieces we have made from bar stock in **ONE** *operation*

RADIAL SLIDES

This universal, Swiss Type, precision machine uses very simple and very inexpensive standard tool bits in place of the conventional indexing turrets, box tools and form tools. These tool bits turn and face the work as the revolving bar stock is being fed forward through the work guide bushing just back of the bits. This guide bushing does the work of the steady rest on a tool room engine lathe, assuring concentricity. ★ The bits are advanced radially to the work and are receded when not in use by means of flat cams mounted on a single camshaft located at the back of the machine. ★ Accuracy of diameters and lengths of shoulders are maintained by means of double micrometer adjustments. Odd shapes, such as radii, complicated forms, and tapers, can be produced by generating the flat cams mounted on the camshaft. Drilling, reaming, counterboring, tapping, threading, etc., are accomplished by attachments mounted on end of machine.

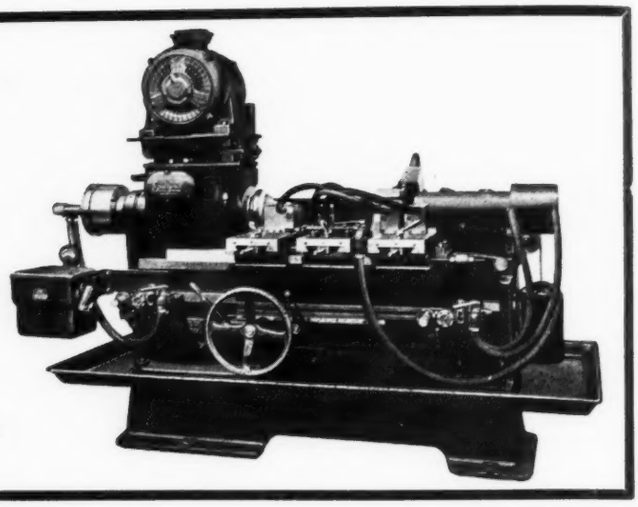
4 SLIDE — Above machine has four radial tool slides with bar capacity of ⅜" diameter and a turning length of 1½" with flat cam and 2¾" with bell cam, and infinitely variable spindle speeds ranging from 675 to 6100.

5 SLIDE — Above machine has five radial tool slides with bar capacity of either ⅜" or ½" with a turning length of 4" with flat cam, and infinitely variable spindle speeds ranging from 755-7500.

THE CITY ENGINEERING CO.

Dayton, Ohio

Ideal . . for High Speed Production of vital war parts such as Shells—Shafts—Gears—Commutators—Motors—Aero Valves—Pistons—Cylinders—Crankshafts—Bearings.



Smallpeice

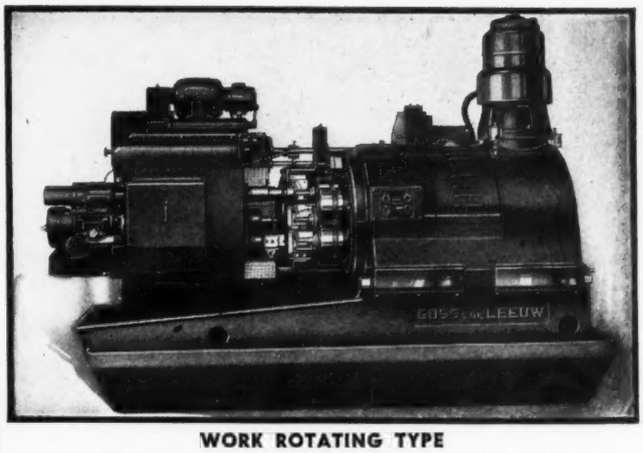
MULTITOOL PRODUCTION LATHE

Versatile — Fast — Accurate — Easily Operated with Simplified Controls—18" swing over bed, 9" swing over cross slide—20 hp. drive on standard 9" model.

Write to **REID BROTHERS, INC., BEVERLY, MASS.**

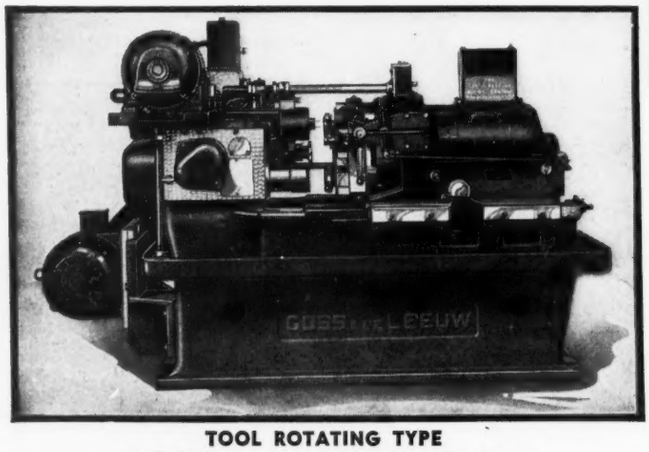
SMALLPEICE, LTD., ELLWOOD L. HOUTZ, AGENT

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

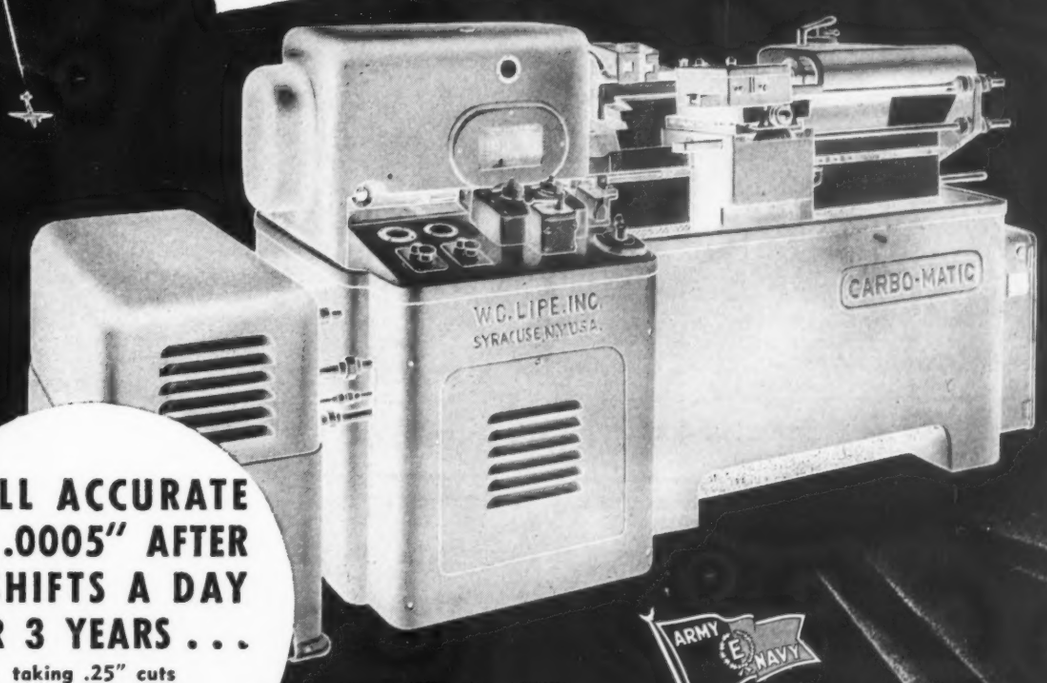
War has proved the Precision, Rigidity and Stamina* of

LIPE
CARBO-MATIC LATHES

Working without stop or let-up for 3 years . . . to constantly finer tolerances . . . and at constantly increasing speeds! That's the test which the urgency of war has put upon Lipe Carbo-Matic Lathes. And they have stood up to it . . . because Lipe engineers foresaw the higher speeds, the deeper cuts, the tougher steels that were bound to follow in the footsteps of carbide tools.

They designed this lathe to take care of those factors. They put in braced and rigid massiveness. They gave it a powerful motor . . . a chatter-free cone-worm-gear drive! Then they made it automatic throughout the complete cycle, so that one man could tend a battery of these lathes—extra speedy though they are. The operator merely loads and unloads. Hydraulic power operates the holding equipment, longitudinal and cross feeds and tail-stock quill. Swing over carriage 8", between centers 20".

You know it's coming—greater wartime and peacetime production than ever before dreamed possible. So write now for complete specifications and delivery dates on the Lipe Carbo-Matic Lathe—product of the famous Lipe engineering shops.



*STILL ACCURATE TO .0005" AFTER 3 SHIFTS A DAY FOR 3 YEARS . . .

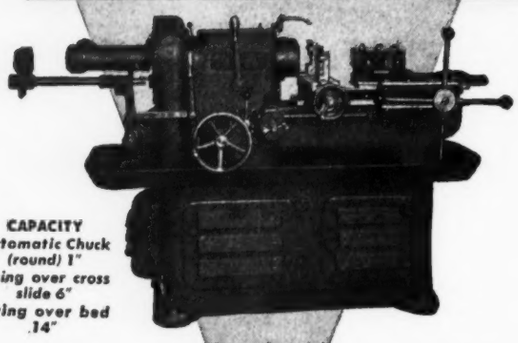
taking .25" cuts with a .030" feed at 600 rpm on 3" H.E. shell forgings

ARMY E NAVY

LIPE ROLLWAY CORPORATION
Syracuse, N. Y.

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

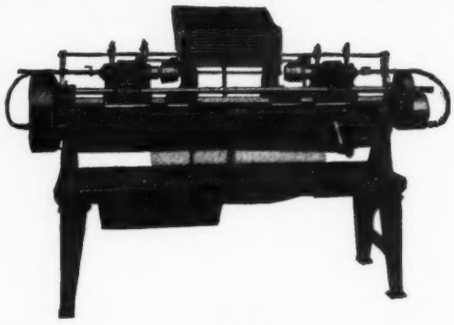
Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 829 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

GRANT

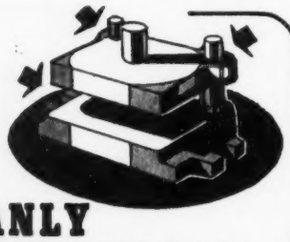
DOUBLE END AUTOMATIC THREADING MACHINES



War Equipment Manufacturers!

GRANT Double End Automatic Machines are in universal use for tapping, external threading and reaming operations on various types of munitions. Capacities up to 1 1/2" diameter, 72" in length. Send samples or prints and get our detailed recommendations.

THE GRANT MFG. & MACHINE CO.
N.W. STATION, BRIDGEPORT, CONN.



DANLY
PRECISION DIE SETS
DANLY MACHINE SPECIALTIES, INC.
2113 S. 52nd Avenue, Chicago, Ill.
MILWAUKEE • LONG ISLAND CITY, N. Y.
DAYTON • DETROIT • ROCHESTER
CLEVELAND • PHILADELPHIA
Ducommun Metals & Supply Co.
Los Angeles • San Francisco

THEIR PRECISION
Means Greater Accuracy In Your Production
Danly Commercial Sets
Danly Special Sets
DANLY
DIEMAKERS' SUPPLIES

ETNA
SWAGING MACHINES

Etna Swaging Machines are built in capacities of 3/8" to 4" dia. with die lengths 1" to 18". Larger sizes built to order.

Write now for booklets!

The ETNA MACHINE Co.
3400 MAPLEWOOD AVE. TOLEDO, OHIO

BETTER-MADE DIE SETS

BAUMBACH

AT LOWER COST

46 DIFFERENT STYLES

OVER 195,000 SIZES

STANDARDIZED
DIE SETS

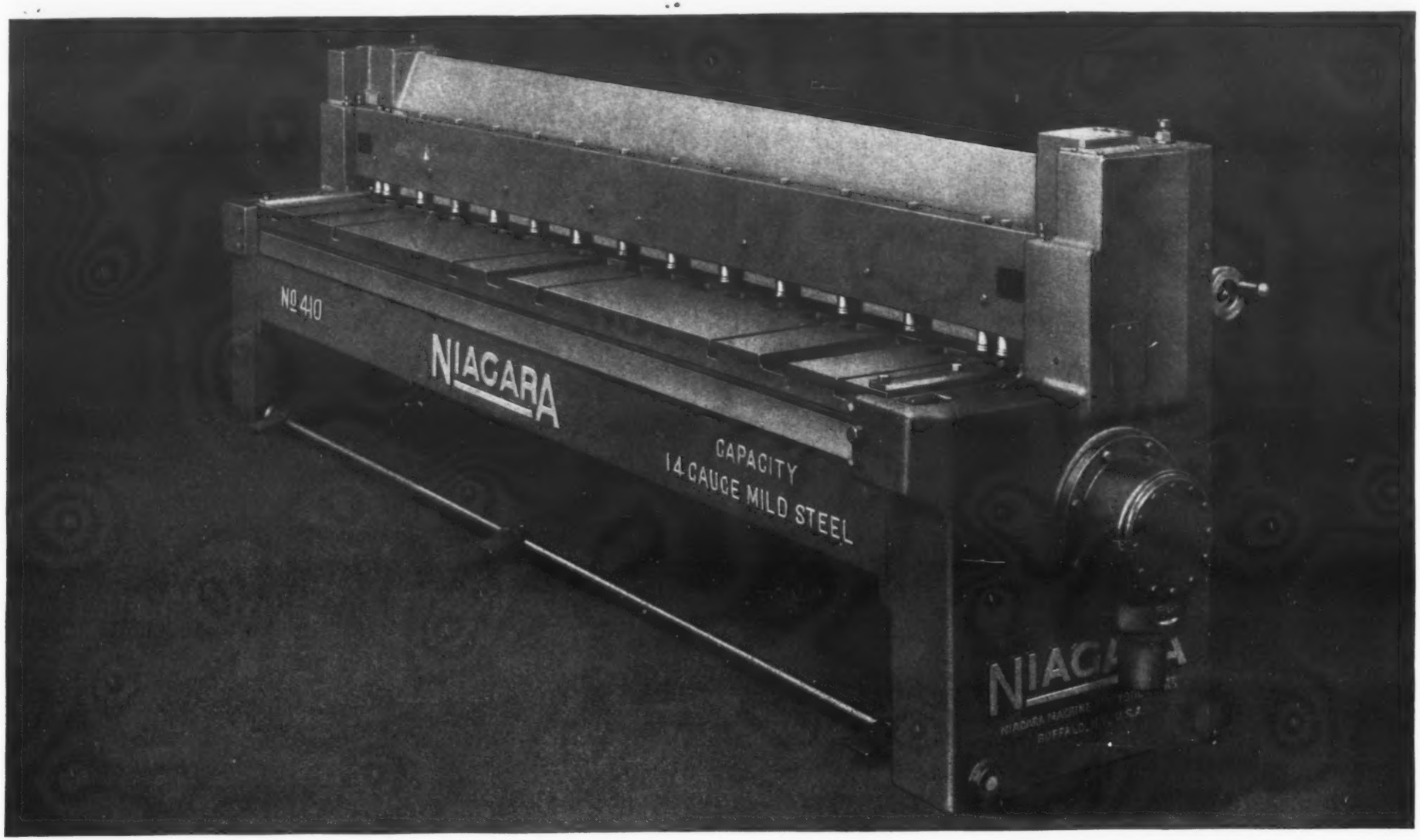
Machined Steel
Semi-Steel
Drop Forged Steel

Send for Our New Catalog
E. A. BAUMBACH MFG. CO.
1810 South Kilbourn Ave. Chicago, Ill.

WRITE FOR CATALOG No. 420

SCHAUER
SPEED LATHES
For Lapping-Finishing-Polishing Small Parts
SCHAUER MACHINE COMPANY
2062 Reading Road, Cincinnati, O.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V & O Press Co., INC.
HUDSON, N. Y.



War plants are obtaining more production per man-hour with Niagara Power Squaring Shears because of accurate cutting, quick setting, ball bearing, self-measuring parallel back gages, full visibility of cutting line, instant acting Niagara sleeve clutch and other modern features.

Enclosed drive with gears, clutch and eccentrics running in oil assure long life and low maintenance cost. Four-edge, solid tool steel knives are standard equipment. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Detroit, Cleveland, New York.

Having a spare set of knives for every shear eliminates lost time while knives are being re-ground. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory regrinding service by the same skilled men who grind new Niagara knives.

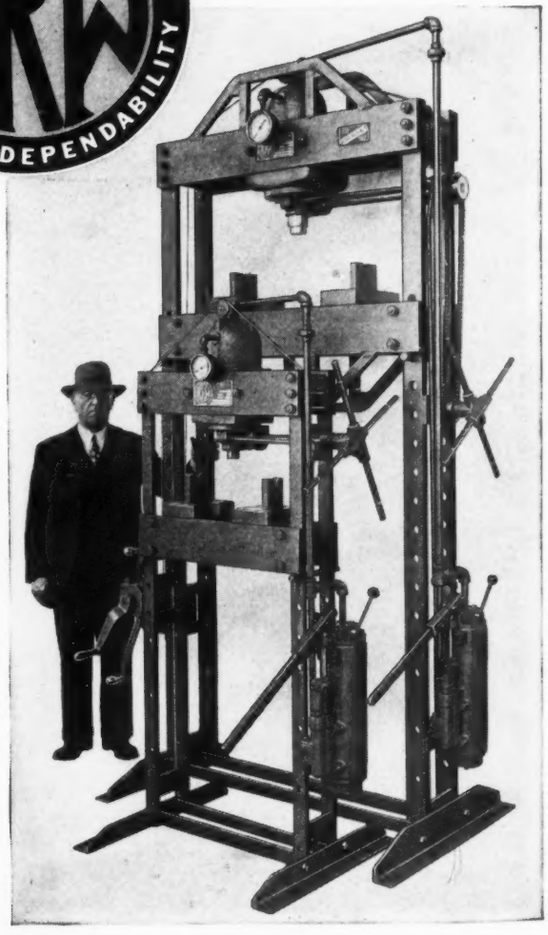
KRW HYDRAULIC ARBOR PRESSES

Engineered for War Production

★ ★

SINCE 1916 KRW A MARK OF DEPENDABILITY

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.



With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: the large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

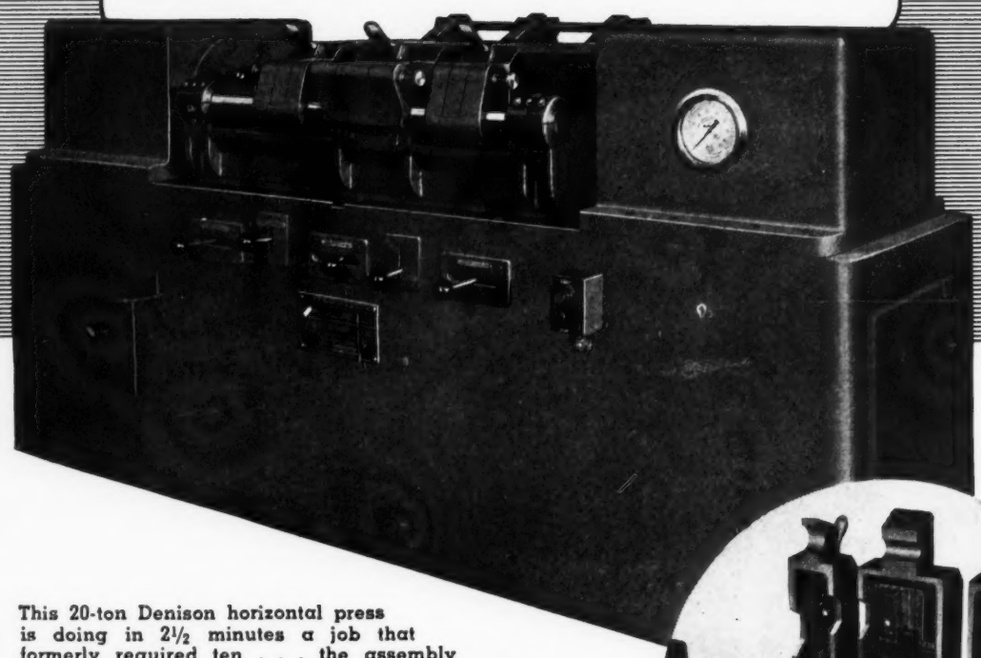
a case for **Cleveland** *Presses*

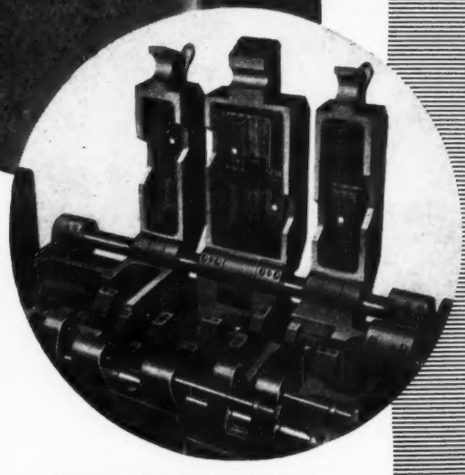
There are several different types of Cleveland Power Presses used in the production of shell cases, each type being particularly suited to perform a given operation or series of operations, such as heading, sizing, drawing, indenting, etc., efficiently and economically.

Maximum production is attained through the use of automatic dial feeds designed by Cleveland Engineers especially for shell case manufacture, and any shell Manufacturer who is contemplating installing additional Presses to accommodate the change over from brass to steel shells, can promptly obtain complete information on Cleveland Presses with automatic dial feeds, on request.

THE CLEVELAND PUNCH & SHEAR WORKS CO. CLEVELAND · OHIO

10-MINUTE ASSEMBLY JOB CUT TO 2½ MINUTES





This 20-ton Denison horizontal press is doing in 2½ minutes a job that formerly required ten . . . the assembly and disassembly of airplane engine crankshafts.

War-rushed plants all over the country are getting help like this from Denison HydrOILics. And this application is only one example of the wide flexibility and ever increasing range of oil hydraulics. In this case, it eliminates tedious, painstaking hand effort and saves valuable time and labor.

The crankshaft is locked in the fixture in three sections, with the center section held rigidly in place and the two end sections remaining movable. Operation of the selector valve directs the hydraulic fluid to either the right or left hand ram. Movement of the ram-operating lever moves the sliding section of the fixture, and assembles the splined external and internal parts of the shaft. The operator then shifts the selector valve, applying pressure to the opposite ram and repeating the operation on the other end of the crankshaft.

This is oil hydraulics at its best . . . speeding war production of critical parts. In almost every industry, Denison HydrOILics is stepping up efficiency, saving materials, eliminating operations, doing jobs faster and better at lower cost.

To find out where Denison HydrOILics can help you, call your Denison representative or write directly to the factory. The Denison Engineering Company, 1152 Dublin Road, Columbus, Ohio.

SPECIFICATIONS

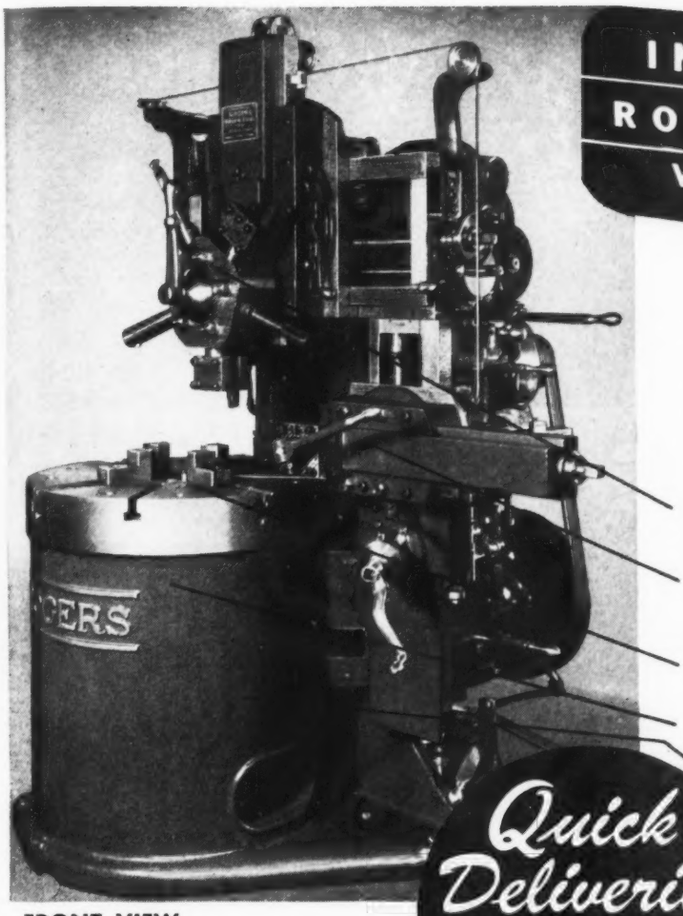
Maximum Stroke, each cylinder	4"
Maximum lateral opening	25"
Size of machined bolster	22"x44"
Depth of throat from center of rams	7" ± .005
Cylinder diameter	6"
Ram diameter	3"
Floor space	28"x93"

Helpful Literature!

A 28-page catalog illustrating Denison standard and special HydrOILic presses and their applications to production problems. Catalog contains a special 12-page section of valuable engineering data and tables. Write for your copy today! On your business letterhead, please.

DENISON EQUIPMENT in APPLIED HydrOILics

INSIDE STORY OF ROGERS "Perfect 36" VERTICAL TURRET MILLS



FRONT VIEW

The main features shown below point out how faster, more accurate boring, turning and drilling of large ferrous and non-ferrous castings, forgings and similar pieces of essential war work are possible with Rogers "Perfect 36" Vertical Turret Mills.

ADJUSTABLE 5-POSITIONED MAIN VERTICAL TURRET CAN BE SET UP TO 30° EACH SIDE OF VERTICAL

ROGERS SPECIAL SWIVEL 4-SIDED, 8-POSITIONED SIDE HEAD PERMITS SETTING AT ANY ANGLE UP TO 35° EACH SIDE OF HORIZONTAL

HORIZONTAL 4-JAWED CHUCK PROVIDES CHUCKING AND MACHINING ON THE LEVEL

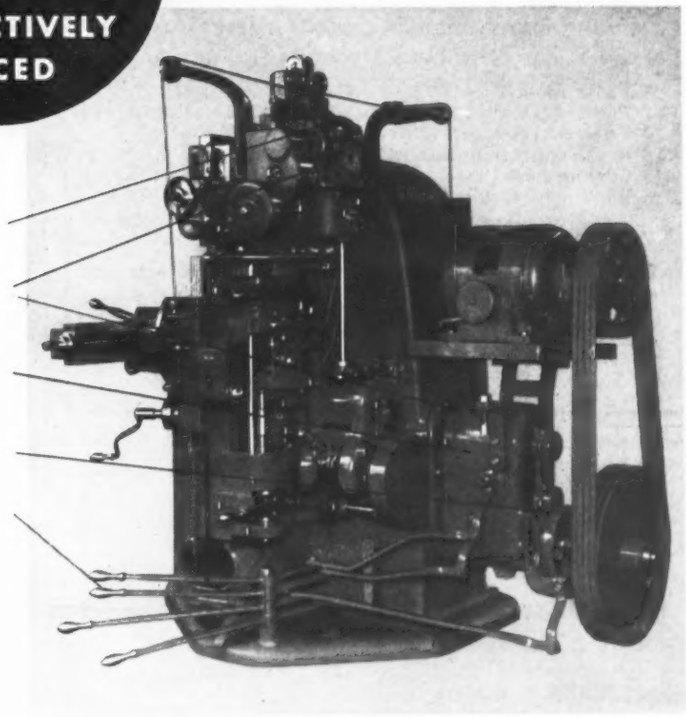
OVERSIZE SPINDLE 6-3/8 INCHES IN DIAMETER RUNS ON SELF-ALIGNING V-SHAPED BABBITT BEARING

STRONG ONE-PIECE FRAME INSURES MAIN AND SIDE HEAD RIGIDITY VERTICALLY, HORIZONTALLY AND TORSIONALLY

Quick Deliveries **AND ATTRACTIVELY PRICED**

Rogers "Perfect 36" Vertical Turret Mills are available in **STANDARD** and **HIGH SPEED** MODELS.

REAR VIEW



MOTOR DRIVEN RAPID TRAVERSE STEPS UP OUTPUT OF WORK

GEARS ENCLOSED IN OILTIGHT CASE ASSURE CONSTANT LUBRICATION

MAIN GEAR BOX IS TOTALLY ENCLOSED AND GEARS RUN IN OIL

MAIN DRIVE CLUTCH CONNECTS THE MAIN DRIVE WITH THE MAIN GEAR BOX

CONVENIENT FOOT CONTROLS FOR QUICK ACCESSIBILITY

Write for complete information and new illustrated catalog today.

Knowing How Since 1885

ROGERS MACHINE WORKS INC.

FACTORY: ALFRED, N. Y.

SALES OFFICES: 133 ARTHUR ST., BUFFALO, N. Y.

TYPICAL EXPRESSION OF COMPLETE SATISFACTION

"Rogers Vertical Turret Mills, since they have been installed, have been in constant service, day and night, on production work and have given us great satisfaction. We are also very much pleased with the prompt delivery and service which we have received."

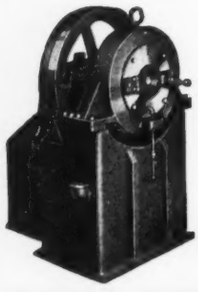
Excerpt from a letter—name on request.

Hanna *Hydraulic* Cylinders

• Bored to a concentric, mirror finish and fitted with rings for oil service — "U" packings for water — they give long-lasting, leak-proof service. Built for operation at pressures up to 1,500 lbs. p.s.i. they are available in many types to suit your requirements. Write for catalog 229.

HANNA ENGINEERING WORKS
1765 ELSTON AVE. • CHICAGO, ILL.

• CYLINDERS • RIVETERS • VALVES • HOISTS •



Swaging—*What* it is and *How* it is done on

TORRINGTON SWAGING MACHINES

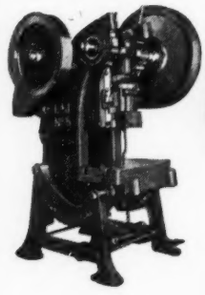
All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

Examples of many possible operations by the Rotary Swaging Method:—

1 Point rods for drawing
2 Pointed rods and tubing
3 Tapered rods and tubing
4 Acetylene torch tips
5 Curling iron tubes
6 Bonding Ferrules to cables
7 Steel furniture legs
8 Tap blanks
9 Banding Rotating Bands on shells
10 Meat hooks
11 Refrigerator expansion bulbs
12 Sizing and Reducing wire

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

THE TORRINGTON CO.
55 Field Street Torrington, Conn.

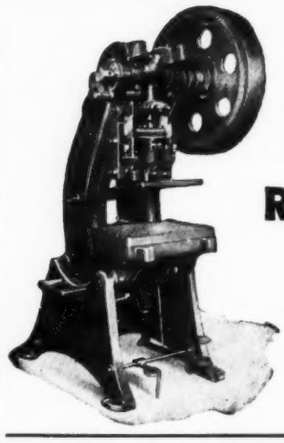


L&J Inclinable
POWER PUNCH PRESSES

No. 5 Back Geared Type
CAPACITY, 49 TONS
SPEED, 45 STROKES PER MINUTE
*STANDARD DIE SPACE, 10¼"
(Bed to slide, stroke down adj. up)
STANDARD STROKE, 4"
WEIGHT, 6700 LBS.
PRECISION BUILT
Write for literature
*No. 5 SPECIAL has 15¼" Die Space

STANDARD SINCE 1911

L & J PRESS CORP. *Elkhart, Ind.*
1631 STERLING AVE.
SUCCESSORS TO LOSHBOUGH JORDAN TOOL & MACHINE CO.



POWER PRESSES

Roll & Dial Feeds

ZEH & HAHNEMANN CO.
182 Vanderpool Street
NEWARK, N. J.

S&S QUICK LOADING STOCK REELS

SINGLE INCLINABLE FOR COILED STRIP STOCK

DOUBLE SWIVEL FOR COILED STRIP STOCK

When feeding stock from coils to punch press or any other machine, the S & S Stock Reels make for speed and economy. Easy to load — no screws to loosen or tighten — dependable. Single Inclinable Reel sets in any plane. Double Swivel Reel permits loading of one coil while other is reeling out stock . . . a "reel time-saver."

S & S MACHINE WORKS, 4541 W. LAKE ST. CHICAGO, ILLINOIS

AUTOMATIC MACHINERY BAIRD BRIDGEPORT CONNECTICUT U.S.A.

MULTIPLE SPINDLE LATHES
MULTIPLE SPINDLE GRINDERS
WIRE FORMING MACHINES
FOOT AND POWER PRESSES
TUMBLING EQUIPMENT

THE BAIRD MACHINE COMPANY
BRIDGEPORT, CONN.

GRAY TURRET HEAD METAL CUTTER OR NIBBLER

GRAY, Originator of First Practical Metal Cutter or Nibbler

Most modern Nibbler for Template Cutting, Tool Rooms, Shipbuilding, Aircraft Parts, Aircraft Tubing, Sheet and Plate Shops.

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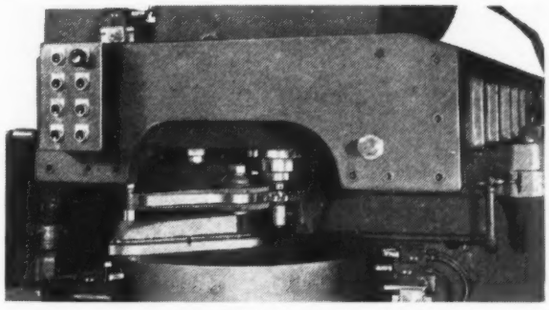
Big DAVIS & THOMPSON *Roto-matics* FULLY AUTOMATIC

Speed Up VICTORY PRODUCTION

Here is another unique example of how Davis & Thompson specially designed automatic machines combine sensational production speed with finest precision to assure the safest fighting planes and best of battle weapons to hasten Victory:

This D&T high production machine has a 34" rotary table (hydraulically operated by oil motor) mounted on a sliding table of 44" movement (driven by another oil motor actuating a screw), with vertical spindle head for feed or rapid traverse forward or reverse (run by a third oil motor, through a screw).



In approximately 20 steps, automatically actuated by solenoid valve controlled limit-switches, the machine completes all the intricate rough- or finish-milling of the channel operations on connecting rods for aircraft engines . . . with speed that cuts time to a fraction of former methods . . . with uniform precision . . . conserving vital metal by reducing rejections . . . saving manpower by automatic operations, completing either job on a single setup, and simplifying inspections.

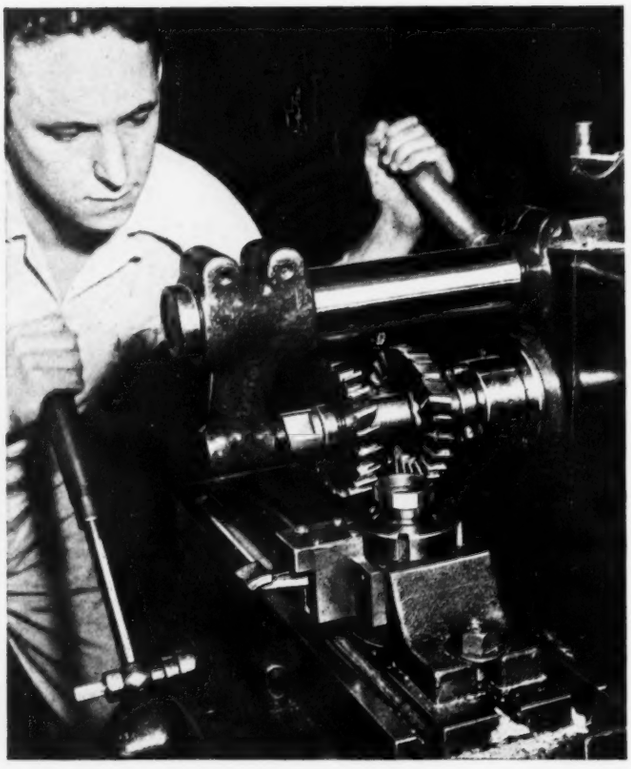
In war or peacetime, Davis & Thompson engineers boost production and cut costs with specially designed machines. You will find this organization well qualified and equipped to analyze your production and to speed output.

Write for copy of the "Victory Production" book.

DAVIS & THOMPSON CO., Milwaukee, Wis., U. S. A.

Buy WAR BONDS *and* STAMPS

D&T ROTO-MATIC HIGH PRODUCTION MACHINERY



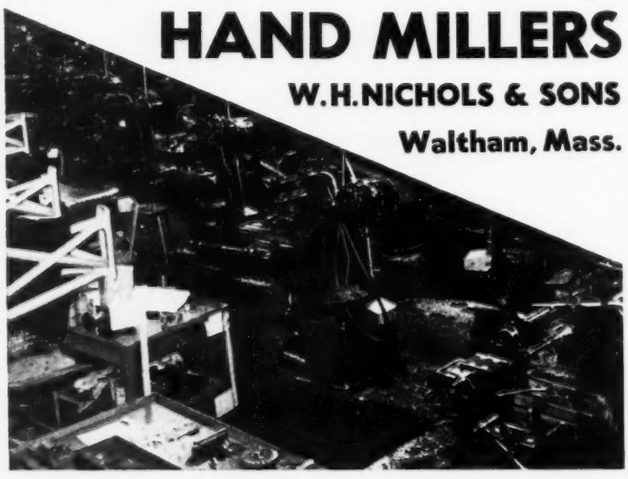
. . . for essential War Production

A large number of munitions plants from coast to coast, embracing practically every branch of the metal-working industries, are today utilizing NICHOLS HAND MILLERS to outstanding advantage. Their current experience with NICHOLS Machines establishes complete confidence in NICHOLS quality and versatility, as the benefits from the following features are fully realized: ACCURATELY GROUND SPINDLES — HAND SCRAPED AND HAND FITTED BEARING SURFACES—PRECISION CONSTRUCTION — TOOLROOM PERFORMANCE AT HIGH PRODUCTION RATES. Typical applications of NICHOLS HAND MILLERS are shown in the accompanying photographs (reprinted by the courtesy of the North American Aviation Co.). Full details will be sent upon request.

NICHOLS HAND MILLERS

W. H. NICHOLS & SONS

Waltham, Mass.



BETTER Small Part Production

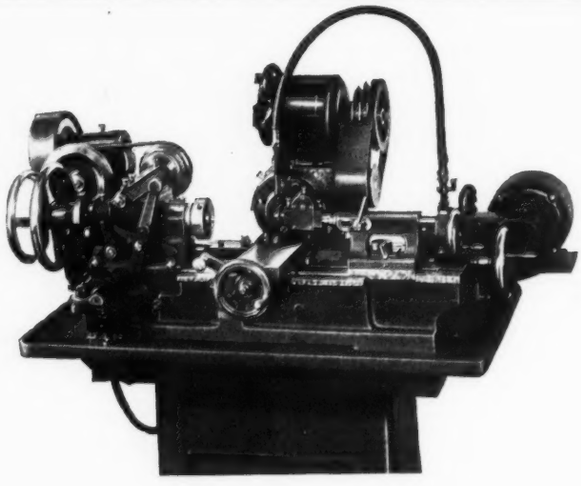
with THE

Get better production and release larger machines for large work! Use the Frew Hand Miller for accurate, economical production of small parts. Heavy construction and "big machine" features guarantee accuracy on heavy cuts. Table size 16¾" x 5¾" makes a wide range of work possible. V-belt drive and Timken-equipped spindle assure smooth operation at all speeds.

FREW

HAND MILLER

THE FREW MACHINE CO. 132 W. VENANGO ST. PHILADELPHIA, PA.



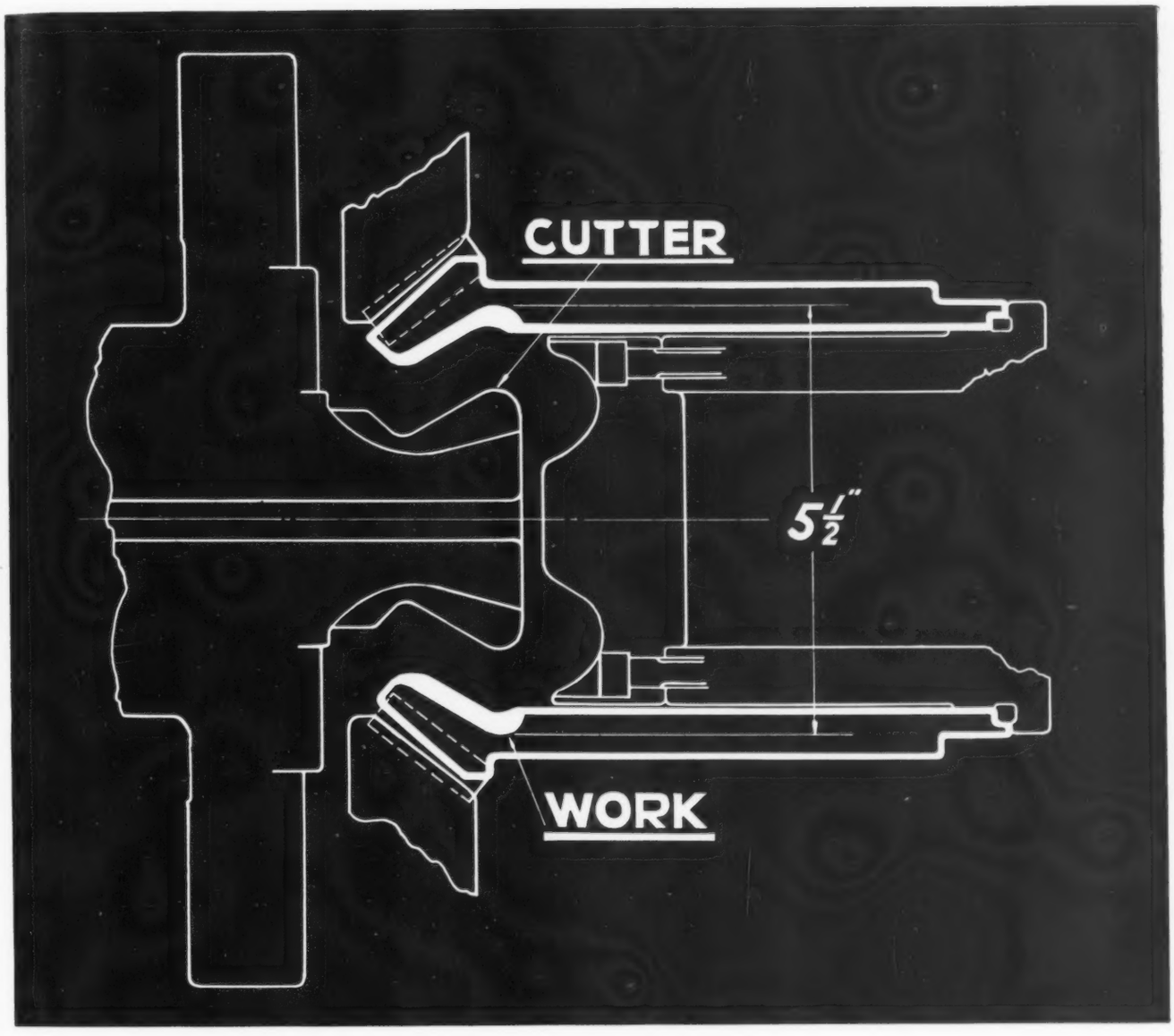
CAPABLE!

THE WALTHAM THREAD MILLER is capable of fast accurate operation on small threads of all types including, by the use of a special cutter head, many internal threads. Almost completely automatic, it can be operated rapidly and efficiently by semi-skilled workers. Write for further details of how this and other Waltham Machines can boost your small part production and toolroom jobs.

WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF. **MACHINE WORKS**

Makers of Small Thread Millers, Gear Cutters and other Automatic Machines

NEWTON STREET, WALTHAM, MASS.



SPEED and EFFICIENCY

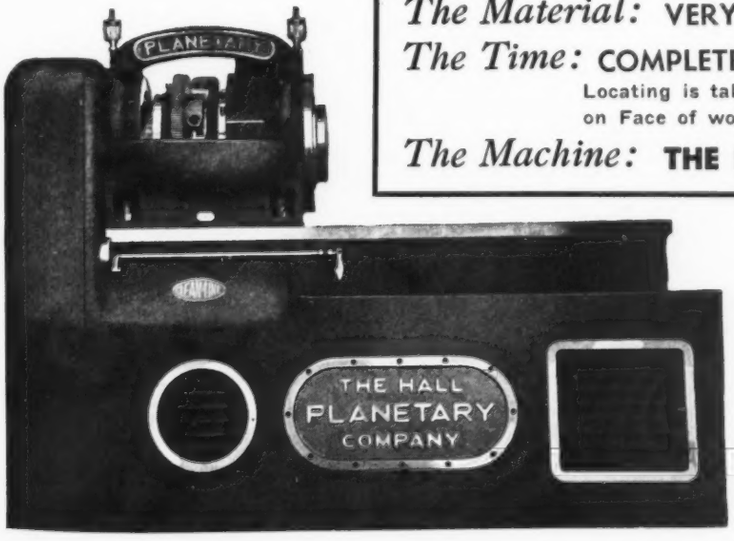
The Job: AIRPLANE PROPELLER PART

The Material: VERY TOUGH, HARD STEEL

The Time: COMPLETE CYCLE APPROXIMATELY 5 MINUTES

Locating is taken from Pitch Diameter of gear teeth on Face of work.

The Machine: **THE HALL PLANETARY**



★ ★

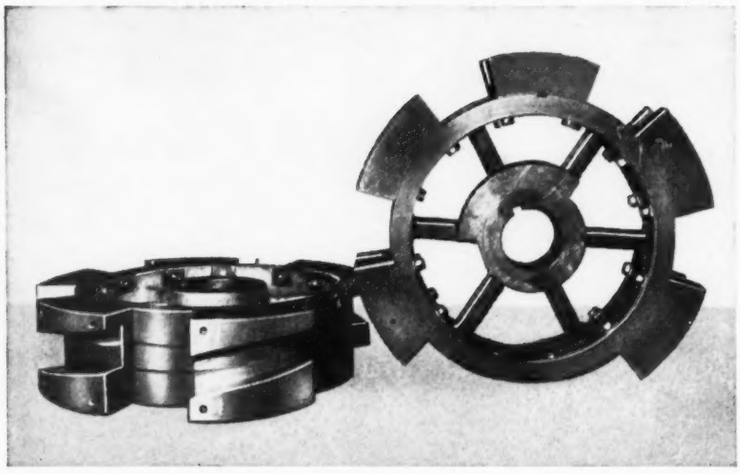
HALL PLANETARY CO.

Fox Street and Abbotsford Avenue

Philadelphia

Complete Information upon Request

Rowbottom for Cams



of Every Type and Size

The cam illustrated—made of interchangeable steel segments—is an example of Rowbottom service in designing and manufacturing cams for unusual applications. For every cam, whatever the material, size, type, or function, get Rowbottom estimates first!

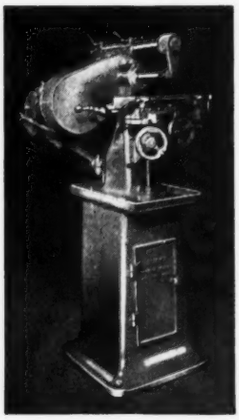
Cams—and cams only! That is why it pays to let Rowbottom handle your problems of cam design and production. Our entire facilities are devoted to cam manufacture only and our experience in this particular field makes Rowbottom the logical choice whenever you need cams.

THE ROWBOTTOM MACHINE CO., Waterbury, Conn., U. S. A.

Douglas 32" X 8" PLAIN MILLER
FOR SMALL PARTS PRODUCTION

EARLY DELIVERY
BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.
150 BROADWAY NEW YORK, N. Y.



BURKE
MILLING MACHINES and ATTACHMENTS

Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3, and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

Burke Machine Tool Co.
297 E. 16th St., CONNEAUT, OHIO

Consult

"NEWARK GEAR"

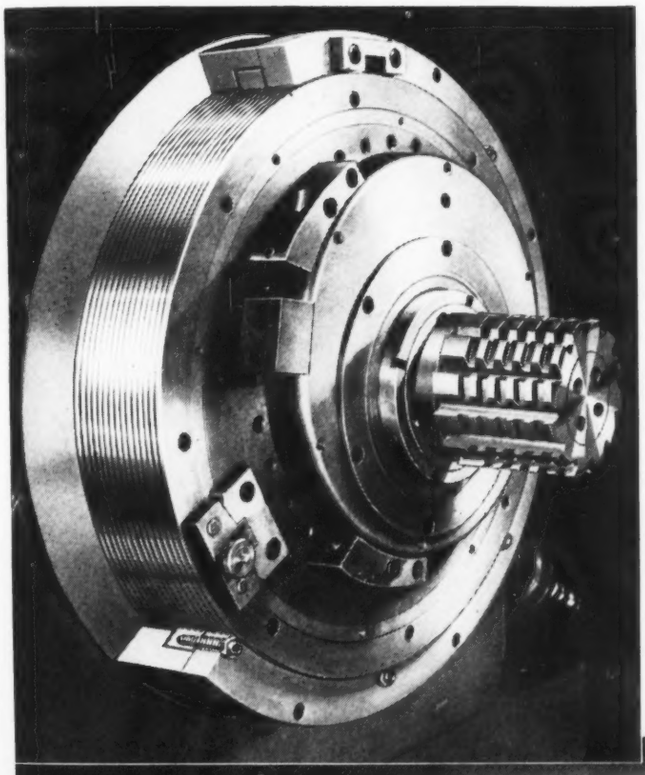
On Your Manufacturing Problems

Gear Cutting Machines

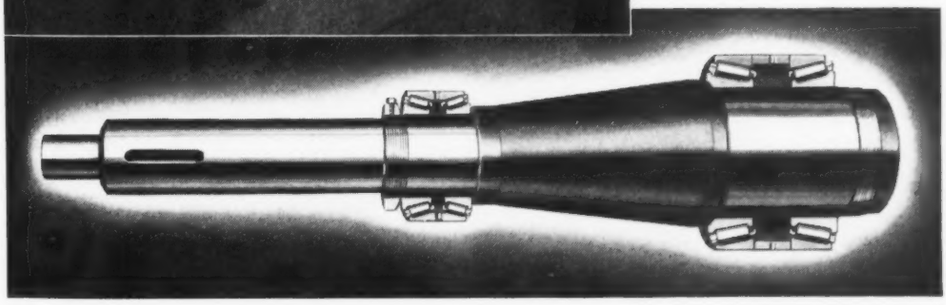
Gear Specialists Since 1904

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect St., NEWARK, N. J.

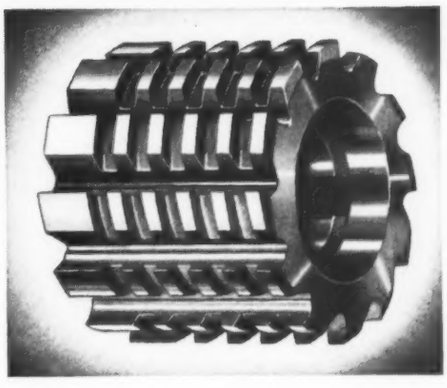
The PLAN-O-MILL *is Accurate!*



ONE big reason why Plan-O-Mill form and thread milling machines are obsoleting older and bulkier equipment is their ability to *produce*. But alongside Plan-O-Mill's amazing production record is a standard of accuracy that many slower, less productive machines are unable to attain. Extra large LEAD SCREW, shown in cutaway view at left, insures extreme thread accuracy—yet even the largest threads are plan-o-milled with a single pass of the cutter!



● The massive Plan-O-Mill SPINDLE (above) revolves on pre-loaded bearings, carries the cutter on a true, vibrationless path. Plan-O-Mill THREAD MILLING CUTTERS (right) are made with the same regard for precision that is evident throughout Plan-O-Mill manufacture. For more information on how Plan-O-Mill can do your threading and form-milling job better, faster, and more accurately, contact the Plan-O-Mill dealer nearest you. See list at right.



PLAN-O-MILL CORPORATION, Hazel Park, Royal Oak, Mich.

PLAN-O-MILL DEALERS

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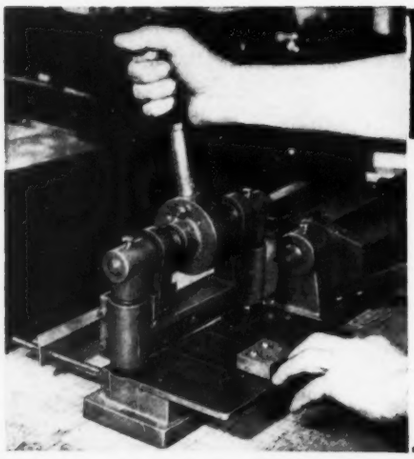
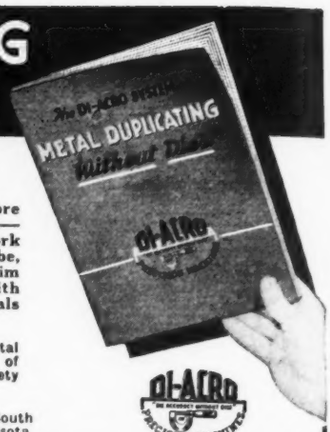
WINDSOR, ONT., CANADA
Standard Machinery Tool Co.

MILLING MACHINES
PLAN-O-MILL
MILLING CUTTERS



METAL DUPLICATING *Without Dies*



Don't Wait for Dies to Get that Job Out!

Speed up for Victory! Many a job can be completed before dies could be made, with DI-ACRO Precision Machines—Shears, Brakes, Benders. For experimental and research work or production runs, DI-ACRO Units form angle, channel, tube, rod, moulding, wire, strip stock; shear stock sheets; trim duplicated stampings. All work accurate to .001". With DIE-LESS DUPLICATING, Man Hours and Critical Materials are regularly saved.

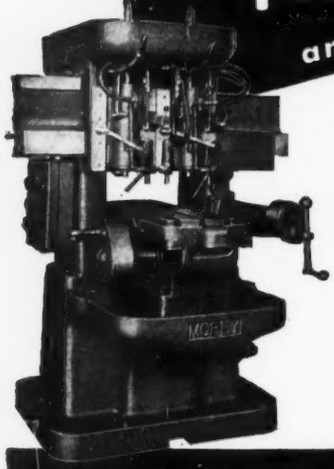
SEND TODAY FOR NEW CATALOG. This 32-page catalog—"Metal Duplicating Without Dies"—gives full information on the capacity of DI-ACRO Shears, Brakes and Benders and illustrates their great variety of time-saving, cost-cutting applications.

O'NEIL-IRWIN MFG. CO. 332—8th Avenue South Minneapolis, Minnesota

DI-ACRO PRECISION MACHINES

Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER



Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

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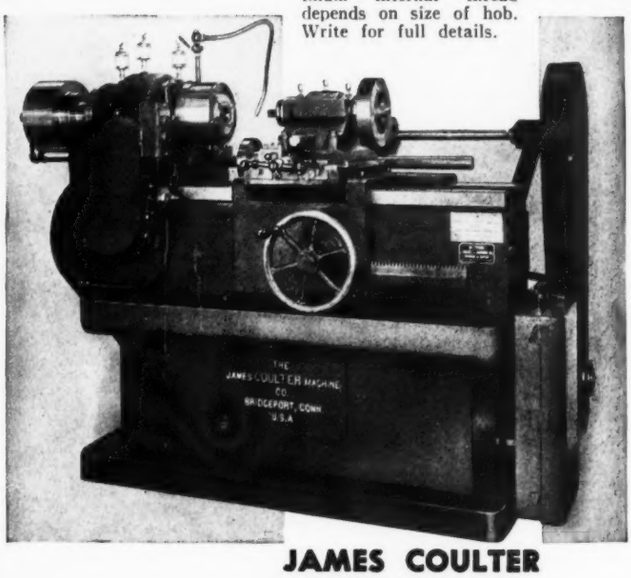
THREAD production—internal or external, right or left hand—through automatic, cam-controlled action! In the Coulter Type H Hob Thread Miller work and cutter spindles are individually motor-driven, permitting high output on any type of work that can be chucked. Maximum external thread, 7"; minimum internal thread depends on size of hob. Write for full details.



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Bridgeport, Conn.

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Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

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ROCHESTER NEW YORK

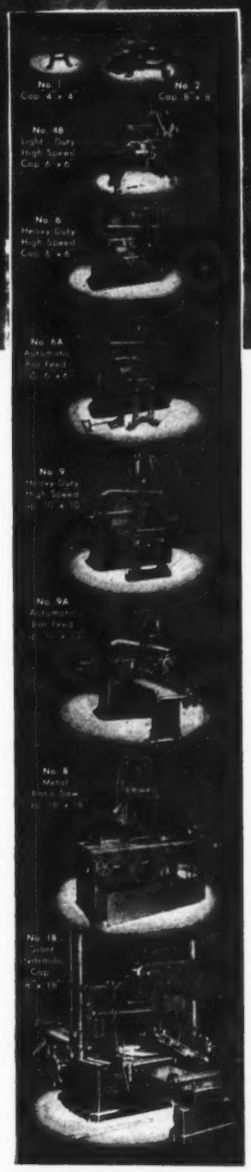
GROB OPEN END SAW

NO SAW WELDING
Instant Internal Sawing

Unsurpassed in speed, efficiency and accuracy of sawing small and medium sized dies as well as miscellaneous parts.

Write or Wire for Details and Prices

GROB BROTHERS
GRAFTON WISCONSIN



"24 hours a day, 7 days a week"

"Have been cutting 3" sq. to 10" sq. slugs to lengths of from 3" to 15 inches, 24 hours a day, 7 days a week for the past 4 years and have been doing a very good job," reports this eastern forge company.

Faster-cutting than any other hack saws, these MARVEL 9A and 6A "Automatic" Saws are built for continuous heavy duty operation, with all moving parts operating on ball-bearings and with automatic bar push up, they require no more operating attention than an automatic screw machine.

The complete MARVEL line provides efficient metal-cutting saws that are exactly suited to the needs of every shop.

ARMSTRONG-BLUM MANUFACTURING CO.

"The Hack Saw People"

Eastern Warehouse and Sales: 225 Lafayette St., New York, N. Y.

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MARVEL SAWS

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
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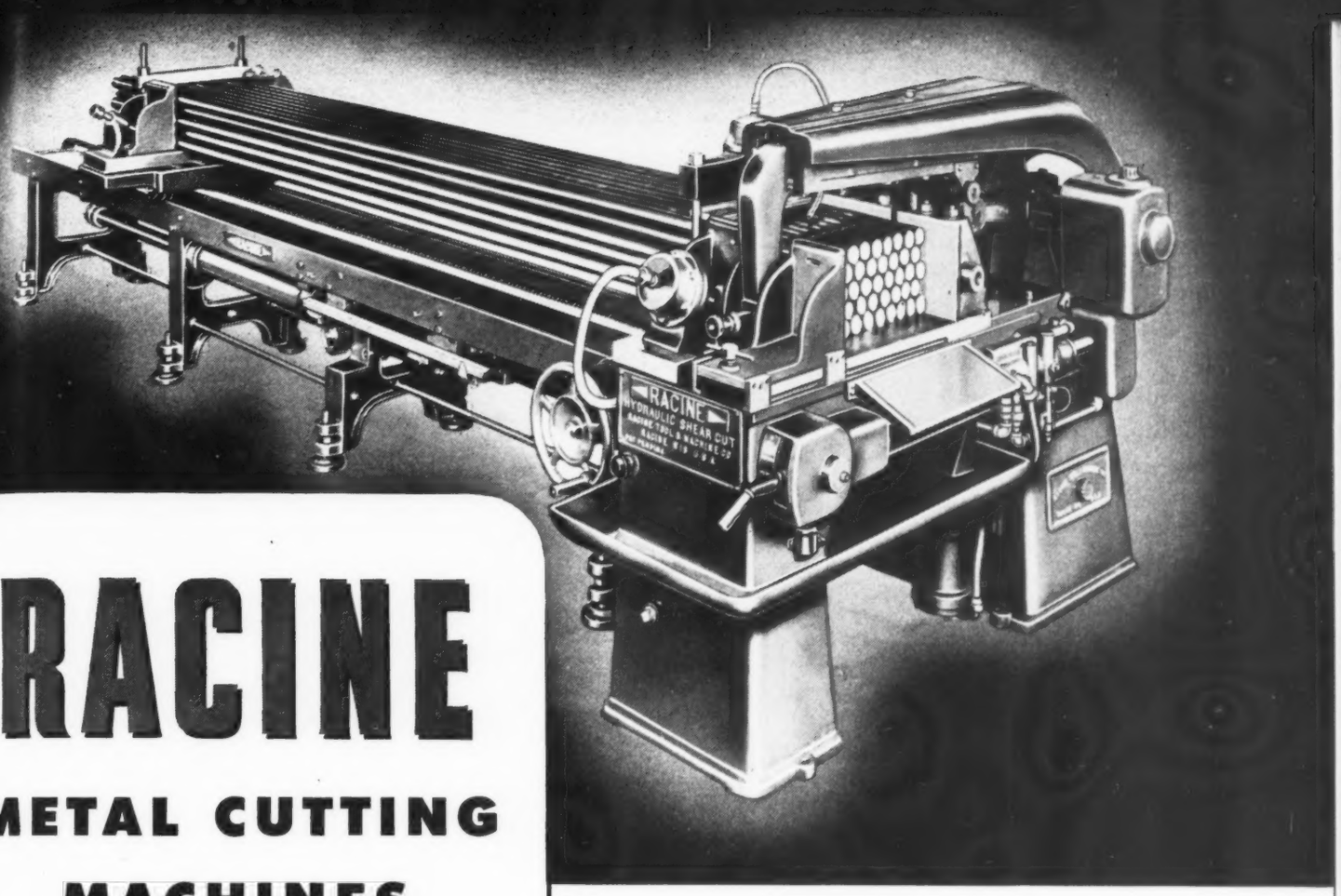
Write for Circular

DEVLIEG MACHINE TOOLS



RACINE

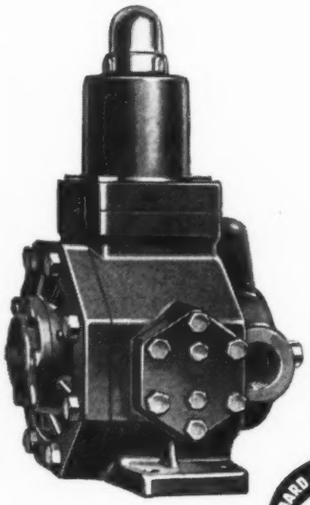
METAL CUTTING MACHINES

Standard for Higher Quality and Greater Precision

THESE Hydraulic Fed and Controlled Metal Cutting Saws with oil cushioned operation save blades, permit faster cutting and heavier cutting feeds. Designed and built for modern production—cutting time and costs can now be accurately determined.

Modern designing of Racine saws produces these outstanding features. Hydraulic control allows complete range of feeds—positive progressive and self-compensating progressive. Single lever control—inexperienced help can operate. Extra heavy pivot shaft and wide pivot bearing construction in arm of Saw Guide prevents cocking or binding strain in bearings and ways.

Racine's complete line includes models for general purpose and production cutting in a wide range of prices and sizes. Capacities 6″ x 6″ to 20″ x 20″. Automatic Stock Feed Machines, as illustrated, are also available.



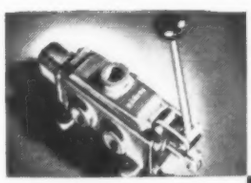
RACINE *Variable Volume* HYDRAULIC PUMPS

A Modern Source of Hydraulic Force

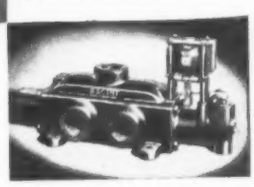
Speed up the production of your power operated equipment with Racine Variable Volume Oil Hydraulic Pumps and Valves.

Pressure from 50 to 1000 lbs. per sq. in. for holding, pressing, clamping, feeding and forming operations.

No relief valve needed. Pumps only the amount of oil you require to do the job. Exclusive "Vane Type Variable Volume" feature. For vibrationless action in modern machine design. Capacities 0-12, 20 and 30 gal. per minute.



Four-way Hydraulic Valves are available with stem, lever, roller, latch, foot treadle and solenoid operating devices. Various porting arrangements can also be furnished to suit your requirements.



Racine's exclusive "Sleeve Type" Hydraulic Valves have balanced pistons. Made in ⅜" to 1½" standard pipe sizes. Continuous bearing and sealing surface—piston cannot sag—always in alignment—insuring longer valve life.

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Choose your shaper to fit your work

THE NEW VERNON PRECISION BACK-GEARED 12" SHAPER has all the important advantages of large machines plus fast production and big savings in first cost, power and floor space. Within its capacity it will do anything as accurately as a larger machine—and do it faster and more economically.

It has the full range of essentials—power, strength, rigidity, speed, smoothness, accuracy, convenience in operation, adjustability, and long life. Its back-gearing provides ample power to drive through deep cuts without chatter or stall. Its helical-type bull gear is mounted in large Timken Tapered Roller Bearings and is adjustable for wear. Its speed is infinitely variable within the range of 15 to 170 strokes per minute.

These and other features make the new Vernon the best shaper on the market to relieve larger machines and get work out faster. Orders placed now get prompt delivery! Send for new bulletin with complete specifications.

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1915 EAST 51 ST., VERNON LOS ANGELES CALIFORNIA
Vernon Line of **HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS**

HAMILTON SWISS TYPE GEAR HOBBERS

for accuracy and speed in hobbing of

pinions, wheels, gear sectors and similar component parts of Aviation Instruments, Time Fuses, Meters, Clocks, Watches, and other precise mechanisms.

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No. 1 SPUR and SPIRAL GEAR HOBBER
for work up to 6" diameter.

No. 00 SPUR GEAR HOBBER
for work up to 2" diameter.

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If your production requires the cutting of highly accurate fine pitch gears and pinions, write TRIPLEX for complete detailed specifications.

Manufactured by
THE HAMILTON TOOL CO.
Hamilton, Ohio

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Exclusively Sold by
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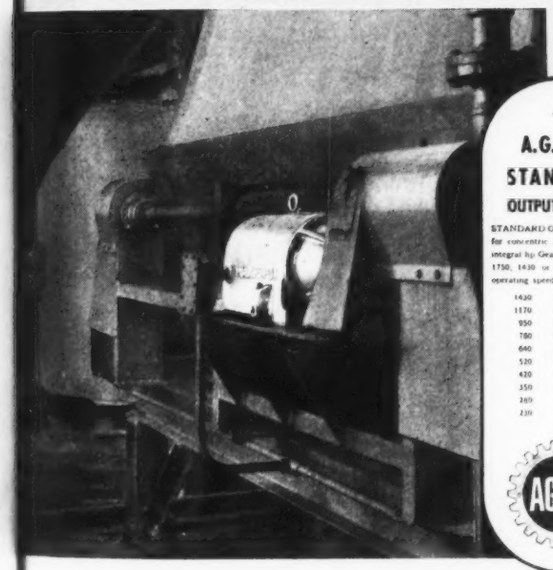
THERE'S INCREASED PRODUCTION FOR MANY WAR PLANTS IN THESE SHIPMENTS OF MOTOREDUCERS



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A.G.M.A. STANDARD OUTPUT SPEEDS

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

1430	190	25
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
520	68	9.0
420	56	7.5
350	45	6.0
260	37	5.0
230	30	4.0

AGMA

The completely-built-in construction of Philadelphia MotoReduceRs with motor and speed reducer in one compact housing greatly speeds-up and simplifies the installation job and gets machines in production faster. In service, their high efficiencies, up to 97%, help get more goods-for-war made. Trouble free operation, that results from balanced design and a construction of the right parts and materials assures an uninterrupted flow of those vitally needed goods.

When planning for a new drive investigate Philadelphia MotoReduceRs first. They're made in horizontal and vertical types in a wide range of reduction ratios and horsepowers. Complete details are found in the MotoReduceR catalog—send for a copy.

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AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
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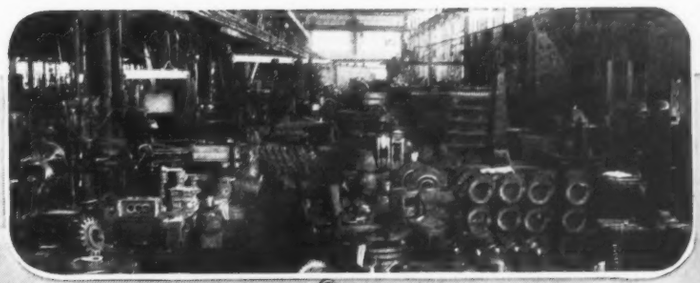
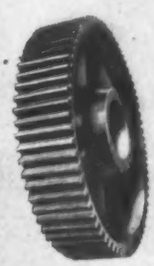


***Philadelphia* LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.



***Philadelphia* GEARS** All types and sizes of industrial gears. Can be supplied in all materials.

***Philadelphia* WORM GEAR SPEED REDUCER** right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.

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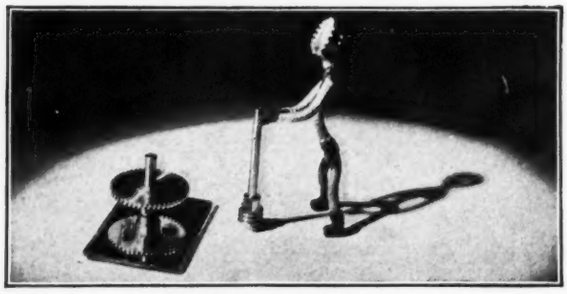

"THEY LIVE ON THE JOB"

DOWN HERE WE MAKE IT SAFER UP THERE

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Massachusetts Gear & Tool Company

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GEARS, GEARS, **GEARS.** Small ones or large • Stahl Gear has only one standard of quality • the best. We invite you to talk over your "big" gear problems with us. Many users could testify that Stahl is "geared" to serve you well. *TRY US.*

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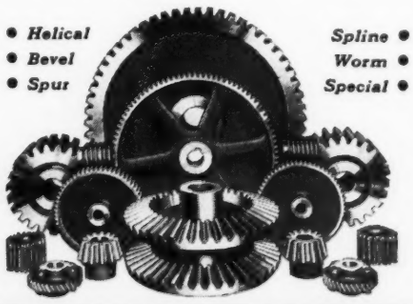
Each Cincinnati Gear "Measures Up" to every industrial requirement.

• *Helical* • *Bevel* • *Spur* • *Spline* • *Worm* • *Special*



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For Many Years Detroit Bevel Gear Has Been a Leader In The Manufacture of Hypoid Gears

This Company Also Produces GEARS OF ALL TYPES In All Materials

In Sizes Ranging from 5/16" to 16"

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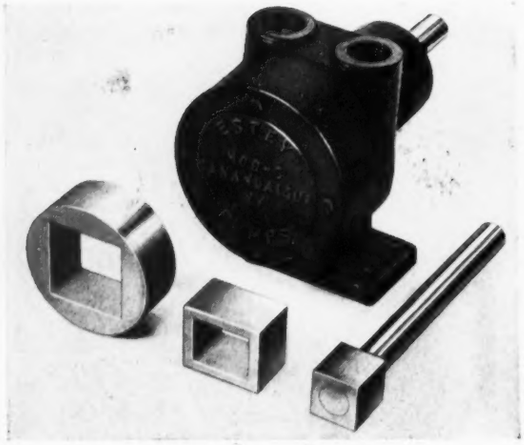

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Wherever extremely accurate control of intermittent machine operation is essential the Hilliard Single Revolution Clutch is unequalled. Its accuracy has won for it the acceptance of Industry for cutting, punching and packaging operations.

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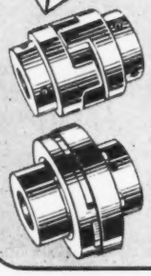

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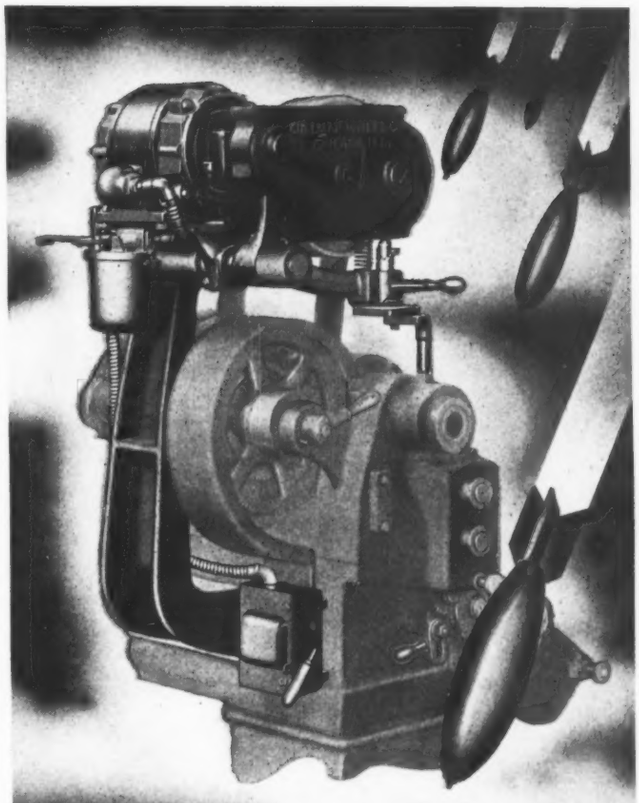

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CULLMAN DRIVES

An increased production of more than 25% is not unusual when lathes, milling machines, screw machines, shapers, and similar equipment, belt driven from shafts, are modernized with Cullman Individual Motor Drives.

Cullman Individual Motor Drives permit more efficient machine arrangement and eliminate belting and shafts that interfere with best lighting. Greater flexibility and safer operation result in increased output.

Cullman Drives are sturdy and built for long life. They operate with belt-drive smoothness. They are easy to install and economical to buy. They are built for motors from ¼ to 15 H. P. Prompt delivery can be made on most sizes.

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Transferred easily from machine to machine or machine to bench—especially useful for pieces difficult to hold in chuck jaws. Catalog of full line on request. **No Wires—No Heating—No Operating Costs.** Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

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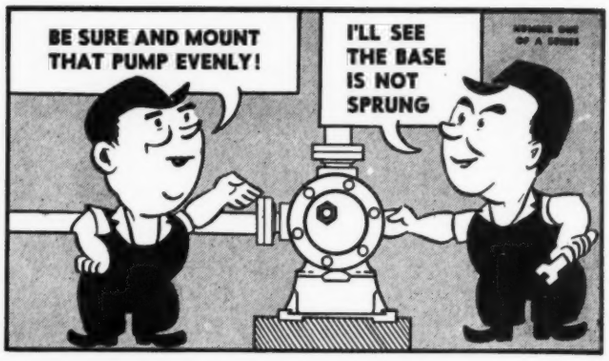

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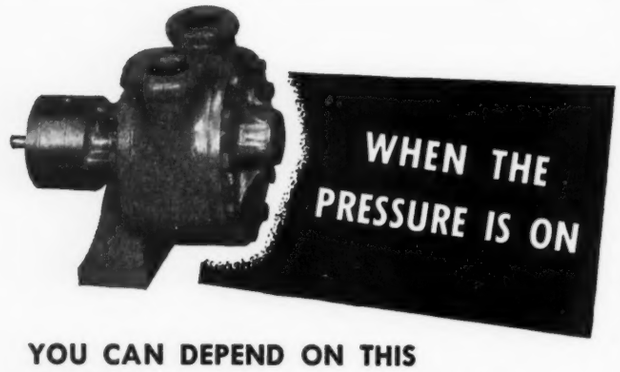
When mounting a Viking Rotary Pump and bolting it down, be sure that the base is not sprung. Bolting the pump down over an uneven surface may cause binding and heating in the stuffing box. It may cause working parts of the pump to bind and wear beyond repair in a short time. The pump must be free enough to turn the shaft by hand.

Get **extra** wear out of your Viking Pumps by giving them **extra** care. The Viking Service Manual tells you how. It's a handy, illustrated booklet giving you practical help in mounting, operating and maintaining Viking Pumps. Write for your copy today. It's FREE.

VIKING Pump COMPANY
CEDAR FALLS, IOWA



WHEN THE PRESSURE IS ON

YOU CAN DEPEND ON THIS
TUTHILL *HIGH-PRESSURE* PUMP

For dependable high-pressure performance on machine tools, engines and hydraulic mechanisms, it will pay you to specify Tuthill Model CK ball-bearing pumps. These positive-displacement internal-gear rotary pumps save space, time, material and money through their compact design and efficient operation. Furnished with direct motor drives, V-belt units and integral drives in capacities from 1 to 50 g.p.m. and pressures up to 400 p.s.i.

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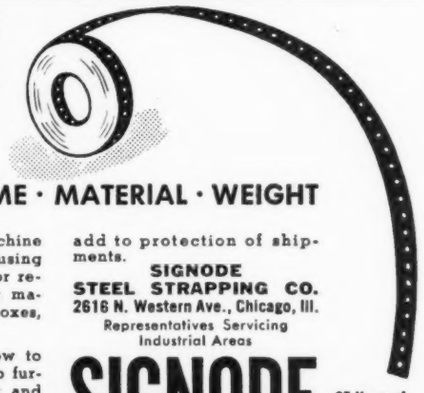
SIGNODE ANCHOR STRAP



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Machinery and Machine Tool Manufacturers are using Signode Anchor Strap for reinforcing and anchoring machine parts and tools in boxes, crates and for skids.

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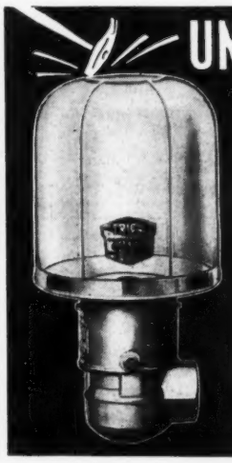
SIGNODE STEEL STRAPPING CO.
2616 N. Western Ave., Chicago, Ill.
Representatives Servicing Industrial Areas

SIGNODE 25 Years of Packing Improvement

UNBREAKABLE OILERS
NEW · MODERN STREAMLINED



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Eliminate all guesswork, messy floors, motor burn-outs and shutdowns for oiling. Fewer man-hours are needed for maintenance. Positive, accurate, dependable lubrication night and day without attention. Glass and unbreakable styles for every application.

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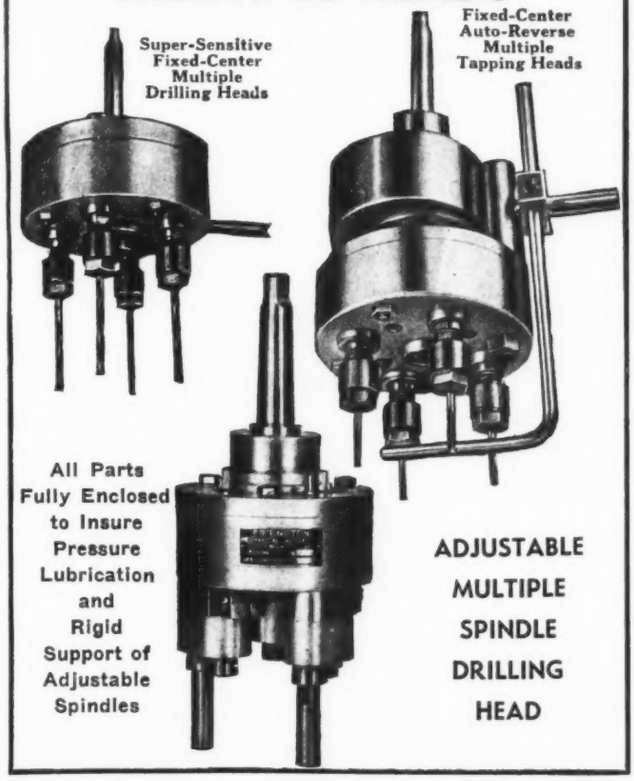
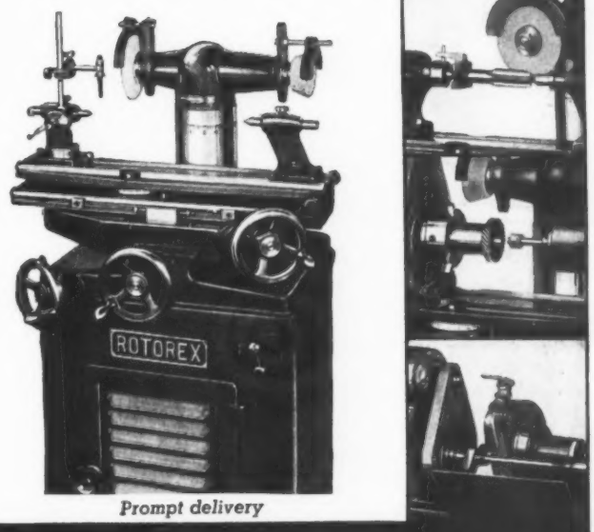
MULTIPLE HEADS


Super-Sensitive Fixed-Center Multiple Drilling Heads
Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

ROTOREX
UNIVERSAL GRINDER
Designed specially for *The Modern Tool Room*



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INFORMATION on MACHINE TOOLS
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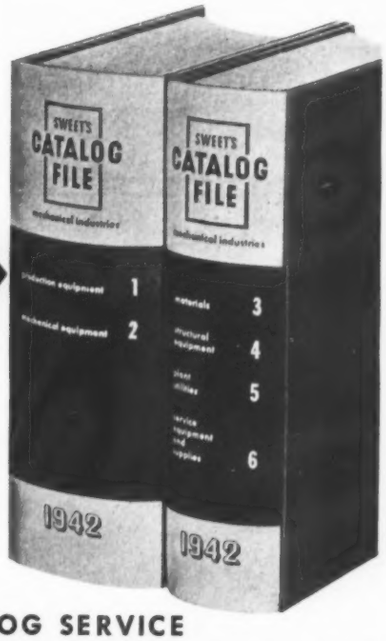
There you will find the catalogs of 110 machine tool builders and manufacturers of attachments, accessories and allied equipment—just the information you need to help you compare and select.

Turn to PRODUCTION EQUIPMENT Section 1



in the 1942 Sweet's File for the Mechanical Industries. No need to write and wait for these manufacturers' catalogs which are instantly accessible at all times in your office or plant.

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. . . if you're troubled with chattering machine tools or hot bearings and gears

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Machinery Oils and Greases

USE "STURACO" — it has a technically accepted load carrying capacity of over 300% more than ordinary lubricants.

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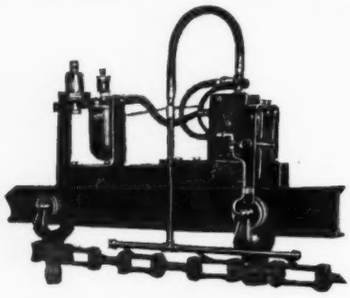

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apply a measured, adjustable amount of lubricant to every trolley wheel-bearing and every conveyor chain link every trip. Models for a variety of applications handle lubricants that range from light oils to heavy fibre greases.

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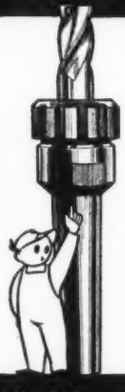

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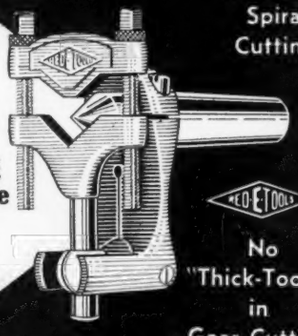
Precision Spiral Cutting!

—when using the RED-E Compensating Milling Machine Dog



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"They turn with the work"

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Each removable head fits TWO sizes of nuts. Three handle sizes . . . each handle takes five different heads. These instantly reversible ratchet wrenches fit over long studs . . . are easy to use in narrow places. Carried by leading mill supply houses.

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ACCURATE ON DEEP BORES IN TOUGH MATERIALS

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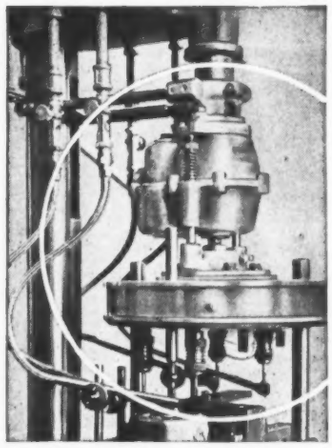
IMPORTANT TO USERS OF Ettco-Emrick MULTIPLE DRILLING and TAPPING HEADS



Nothing is more important to the war effort than **maximum production** in an **uninterrupted flow.** From each piece of equipment you must obtain the highest output it is capable of giving. To get full benefit of the high productivity of Ettco-Emrick Multiple Spindle Drilling and Tapping Heads it is essential to observe the following points regarding their use and care.

1. Your Ettco-Emrick Multiple Drilling or Tapping Head is an individualized piece of equipment. It was engineered to give you **maximum** drilling or tapping production on a specific part. With it, you received recommendations as to the best way to handle parts, the most effective design of work holder, the proper drills or taps to use and the proper operating speed. To get the intended production, all of these recommendations must be followed. If in doubt on any point, ask us.

2. Don't attempt to use any but the drill or tap chucks supplied with the Heads.

3. These Heads are high-speed, precision-made tools and, like any such tool, must be given a certain amount of care. For example, the gear case requires a good grade of grease—but not too much. Again, when in doubt on any point, ask us.

4. When replacements become necessary, don't attempt to make them yourself. The quickest and surest way is to return the Head to us. These Heads are made of standard parts which we have in stock.

5. Remember, we are at all times ready to help you get the high production and excellent service these Heads give when properly used and cared for.

IMPORTANT TO NON-USERS

If you need **higher production** in drilling or tapping or both, Ettco-Emrick Multiple Drilling and Tapping Heads will give it to you. They provide both the method and the equipment for drilling or tapping the **maximum number of holes simultaneously.** Get full details in **Bulletin No. 3.** Copy mailed to you on request.

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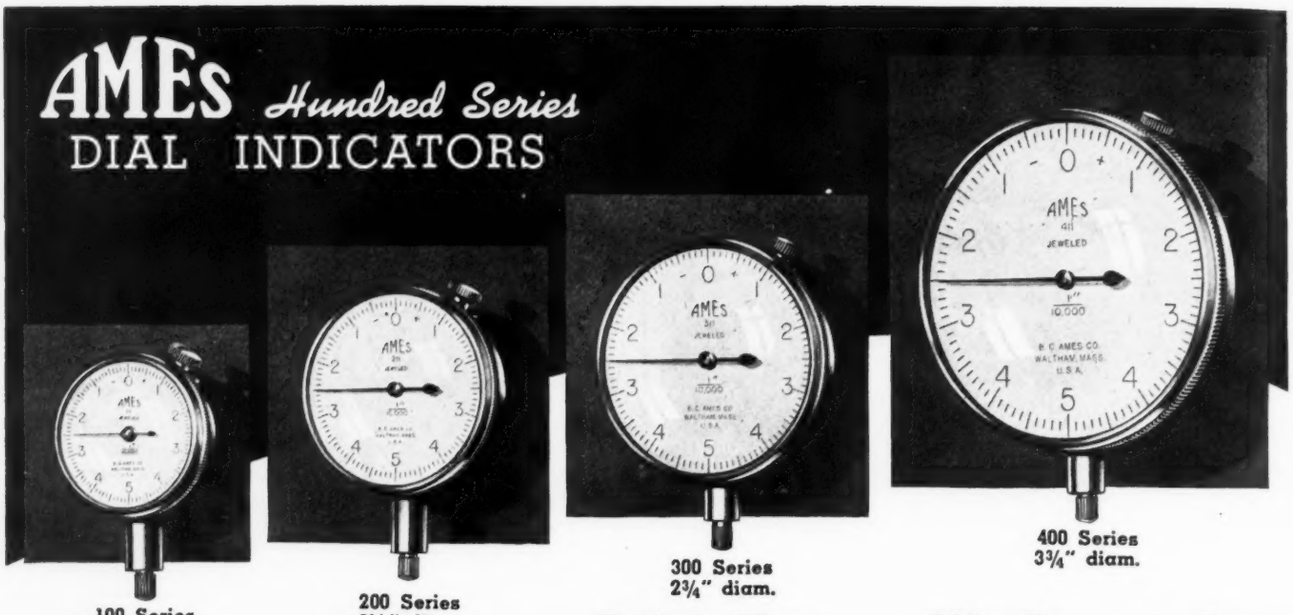
The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

AMEs *Hundred Series* DIAL INDICATORS



100 Series
1-11/16" diam.

200 Series
2¼" diam.

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2¾" diam.

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3¾" diam.

Entirely New . . . Alike Except in Size

A complete line of modern indicators of the latest design and with exclusive features, developed from experience gained during a half century of manufacturing only the finest instruments of their kind. Superior to all others in quality, accuracy and durability, yet they cost no more. Investigate and compare them.

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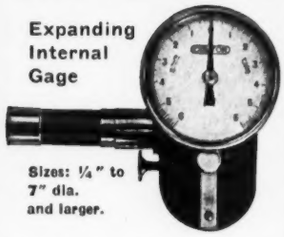
Trainees gage dependably to fractions of .0001" with COMTORPLUG!

Enables the relatively unskilled to perform precision gaging

COMTORPLUG

Expanding Internal Gage



Sizes: ¼" to 7" dia. and larger.

Comtorplug is a precision internal gage that gives positive 2-point gaging, due to patented features of automatic centering and alignment. Not a limit gage—not a passing reading. Shows ACTUAL MEASUREMENT, to fractions of .0001", of any part of a bore, detecting out-of-round, front or back taper, barrel shape, bell mouth, etc., and gaging to the very bottom of blind holes. Widely used in ordnance, airplane, automotive, electrical and other industries where precision of bores is vital.

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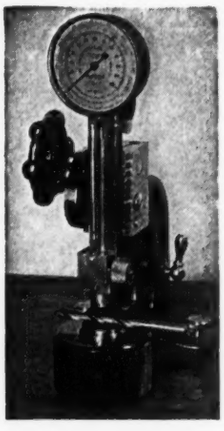

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Brinell — Shore — Scale

Included in our improved Portable Scleroscope Model D-1. This efficient single scale tester registers Brinell-Shore values without damage to the work. The old standby during the First World War is ready to serve again.

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their removal to

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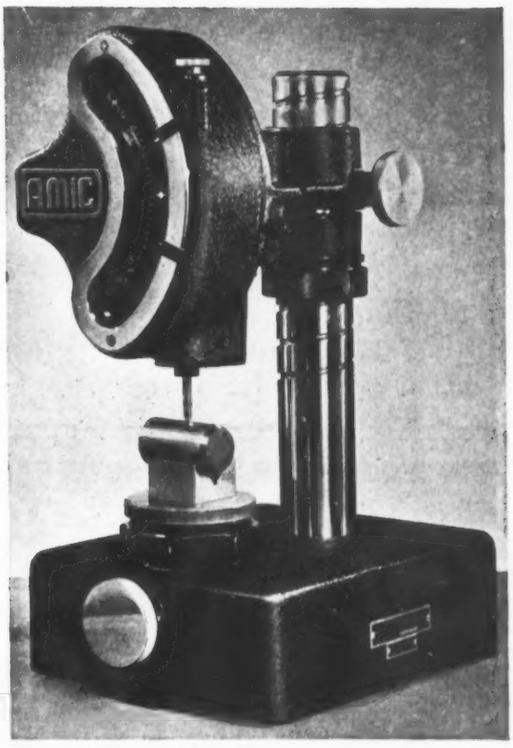
where augmented facilities, efforts and skills will be, as in the past, at the disposal of their clients.



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240 WEST 40th STREET, NEW YORK, N. Y.

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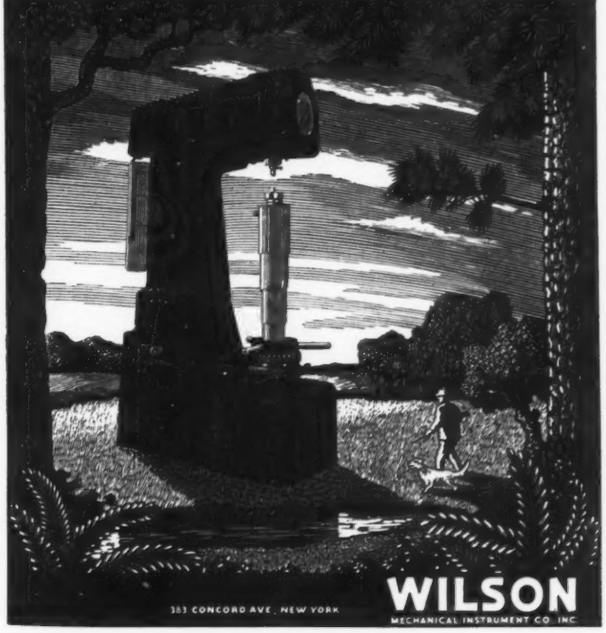

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MECHANICAL INSTRUMENT CO., INC.

PROMPT DELIVERY

Precision Ground **THREAD PLUG & RING GAUGES**

Prove Your Product

- American National Coarse Threads
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- In Accordance to A.G.D.
- Single End—Double End Plugs—Combination of a thread plug and plain core plug for minor diameters
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ROGERS REAMERS

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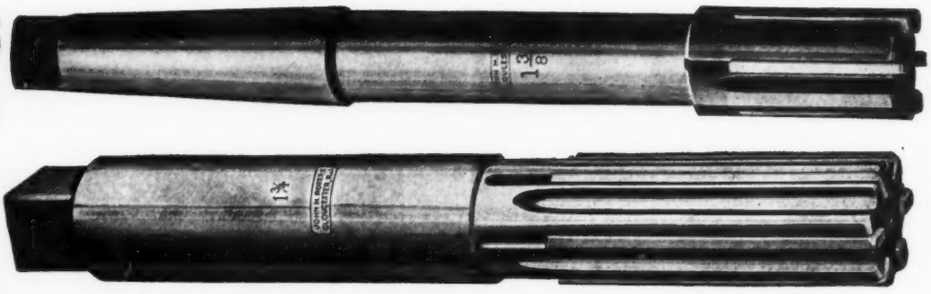

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Conserve High Speed Steel. Use Rogers Inserted Blade Adjustable-for-wear Reamers.

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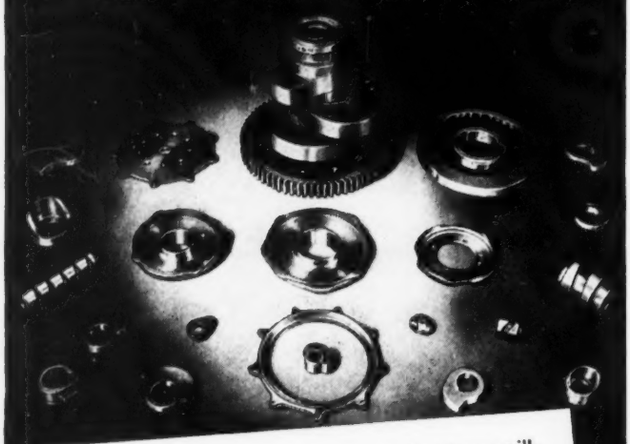

LET the largest, most completely equipped cam milling plant in the mid-west handle your cam problems. All sizes of drum, face, groove or other styles of cams cut to order in quantities of one or one thousand. Send specifications or blueprints for a quotation on your requirements.

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SPEEDS UP STOCK-ROOM SERVICE

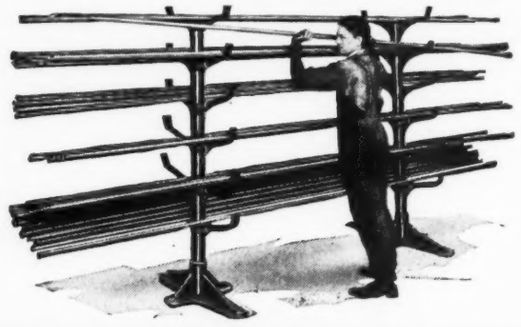
The BROWN SECTIONAL RACK displays each diameter and length of stock in visible array for instant selection and removal, consequently it speeds up Stock-Room service and saves the time wasted by workmen waiting for materials.

The Brown Rack saves the time lost end-hauling each bar its entire length when the old-style, closed-side rack is used: the Brown Rack requiring but a few inches of side movement.

Any time you require additional storage space, all you need do is add more units. If you want to re-locate it at any time, you can do so quickly for it is unattached to the building.

It is a simple, durable article made of metal in five styles. It can't burn, warp, sag or twist: depreciation is practically nil. SEND FOR BULLETIN No. 26-Y describing

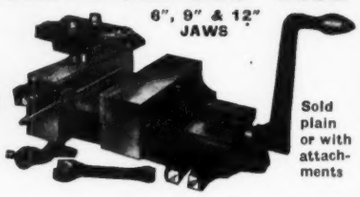
THE BROWN SECTIONAL RACK



BROWN ENGINEERING CO. 131 N. THIRD ST. READING, PA.

GRAHAM MULTI-PURPOSE VISE

Attachments make it a jig or fixture that can be used many ways



Sold plain or with attachments

On drill press, radial, miller, planer, shaper, and grinder this vise handles repeat-operation jobs like a custom-made jig. Flush construction to precision parallels and right angles. Heavy duty construction.

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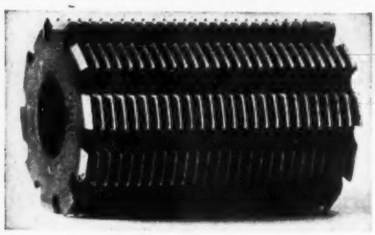


MULTIPLE THREAD MILLING HOBS

in any thread system, any thread angle, any thread form. Up to 7" O.D. and 4" thread length for external or internal threading.

Tolerances: Cut on machines adjustable for tolerances up to 1/10,000".

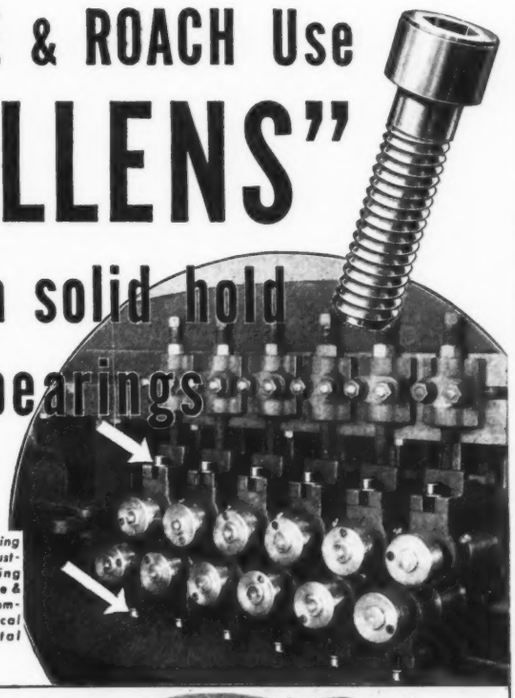
All hobs demagnetized, relieving chips immediately.

"For quick action call plant at Clinton, Indiana, Telephone 85".

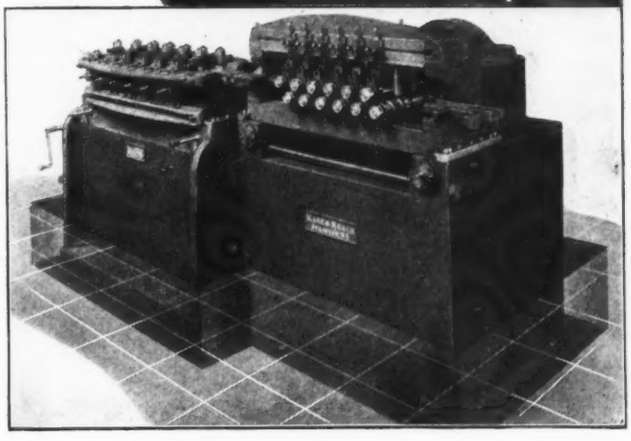
DELIVERY TIME: from one week on.

U.S. MACHINE TOOL MFG. CORPORATION
100 So. 6th Street TERRE HAUTE, IND.

KANE & ROACH Use "ALLENS" for a solid hold on bearings



Close-up of bearing supports and adjusting screws holding roll shafts in Kane & Roach No. BBH Combination Vertical and Horizontal Straightener.



This KANE & ROACH "BBH" Combination Vertical and Horizontal Straightener does fast, versatile work in straightening squares, flats, hexagons, octagons, channels and numerous special and structural shapes. The 24 roll shafts are power-driven, and *adjustable lengthwise* of the stock being straightened. This allows the machine to be adjusted for the best longitudinal roll spacings for the type of section to be straightened.

Convenient adjustment of roll shaft bearings must be clinched with the solidest possible set-ups for accurate alignment. ALLEN *"pressur-formd"* Socket Head Cap Screws are handily and rigidly set up with hexagon keys. They HOLD the bearing supports in a grip that never works loose.

Allen is proud of its tie-in with the famous performance of Kane & Roach machines. Hollow screws are little things to these builders of steel mill equipment. But their exacting selection of little things confirms the quality of the bigger things in Kane & Roach construction.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

IF IT'S HEAT RESISTANCE YOU WANT

Exhaust collector rings, machine gun blast tubes and other products withstand corrosion and high heat, they have *longer service lives*—thanks to Carpenter Welded Stainless Tubing.

The *uniform wall thickness* of this tubing means that there are no thin spots to "burn out" first. And it is ductile, easy to fabricate—thus helping to speed the production of vital wartime equipment that must win battles against excessive heat. Then too, tubes are *natural design units*. Parts can often be finish-formed by merely swaging, tapering, expanding, etc.

If you have a wartime heat resistance problem that must be solved right now, take advantage of Carpenter's diversified experience in many plants where similar problems have been met and solved.

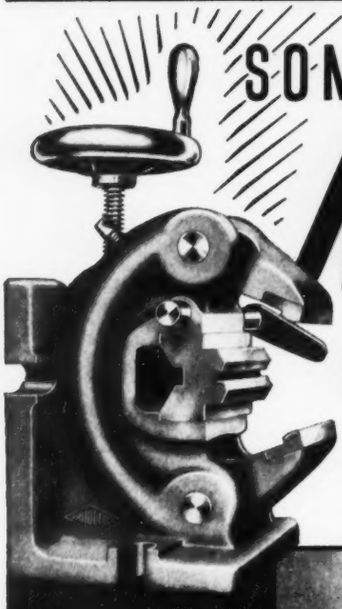
FOR HELP in applying Welded Stainless Tubing, ask for our series of "Quick Facts" bulletins. They contain practical working information to help you with new design and fabricating problems. A note on your company letterhead will start a set of "Quick Facts" bulletins on the way to your desk.

CARPENTER WELDED STAINLESS TUBING
meets Army and Navy specifications; resists corrosion, heat and wear; is 100% hydrostatically tested.

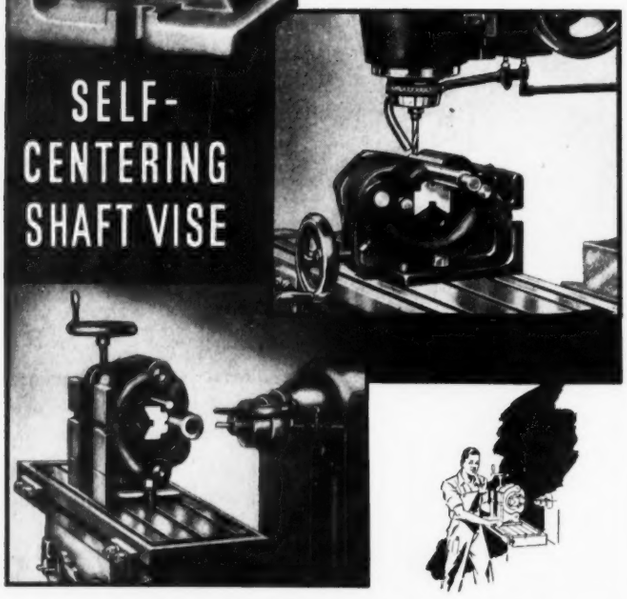
THE CARPENTER STEEL COMPANY
Welded Alloy Tube Div. • Kenilworth, N. J.

Carpenter
WELDED
STAINLESS TUBING

SOMETHING *NEW* HAS BEEN ADDED!



SELF-CENTERING SHAFT VISE



TO THE LINE OF **PRODUCTO**
MODERN MACHINE VISES

An entirely new idea in Vise construction is this Country. For machining keyways and slots in shafts or spindles — range of sizes ⅜″ to 3⅛″ diameter — suitable for vertical or horizontal mounting. Setting of Vise remains unaltered for all work diameters and insures accurate radial cuts. Shafts correctly located in V jaw by equal movement of two jaws. Hardened V jaw reversible in Vise.

Size of Base 8″ x 7¼″ — Approximate weight 80 lbs.

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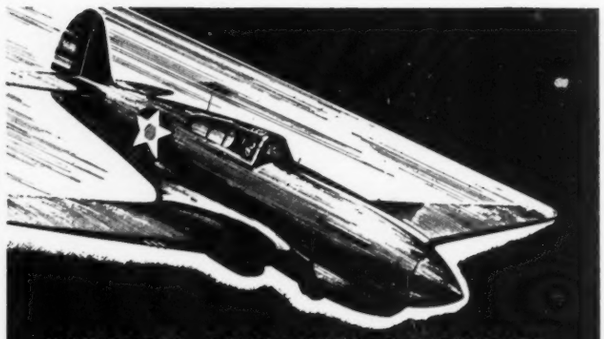

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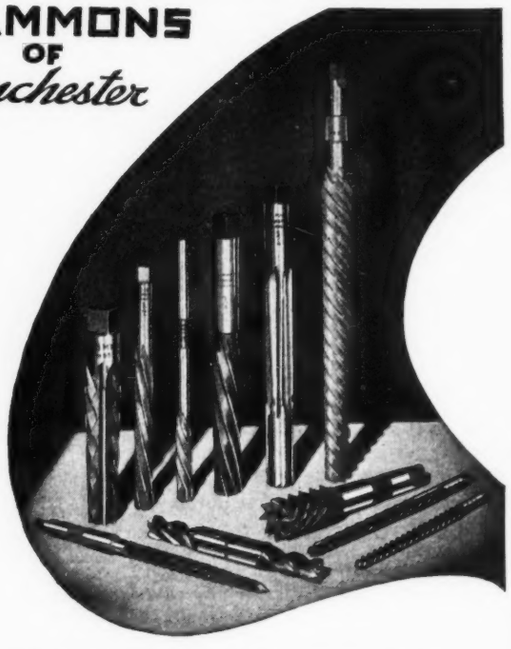

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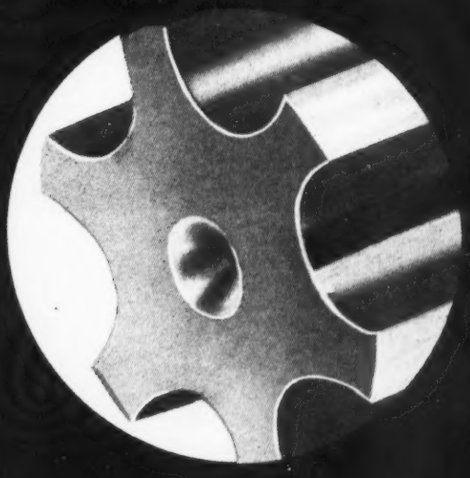

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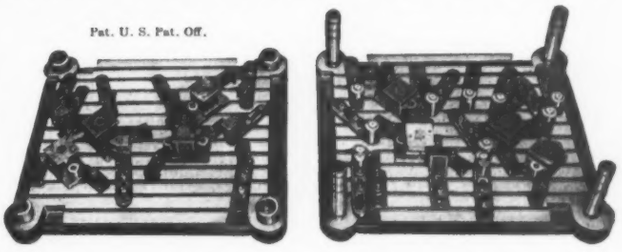

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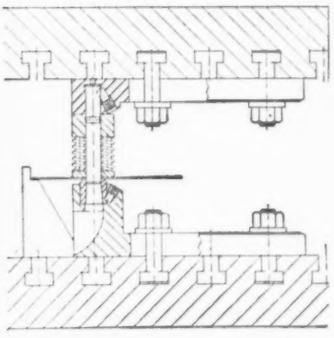
Side view showing construction detail of a U-50, 0″ to ½″ Whistler Adjustable Perforating Punch Assembly and typical example of perforated and notched piece produced by a Whistler Adjustable Die Assembly.



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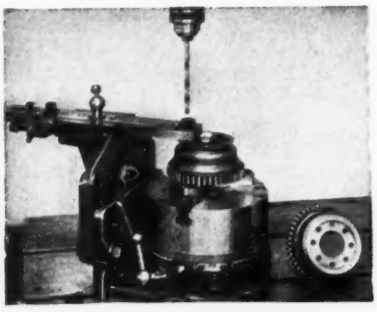

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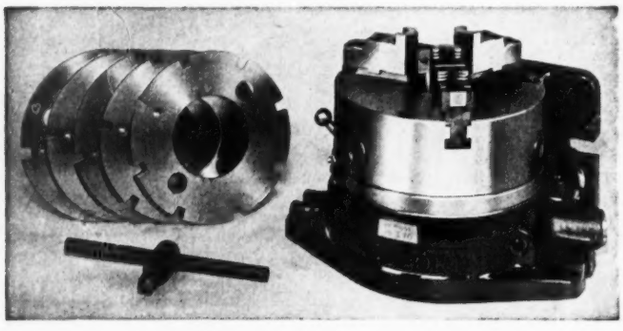

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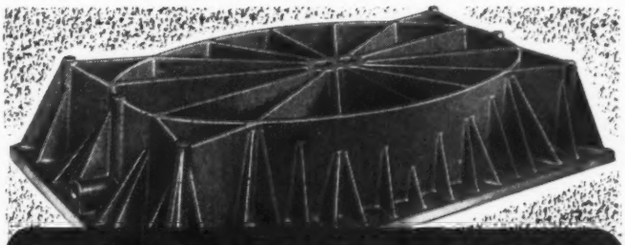

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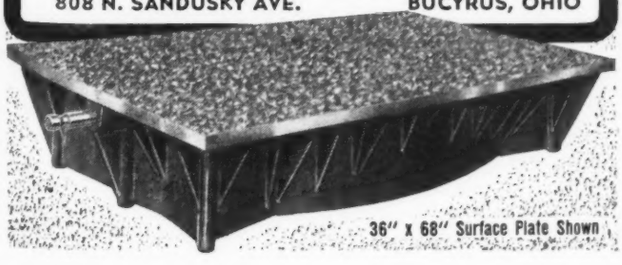

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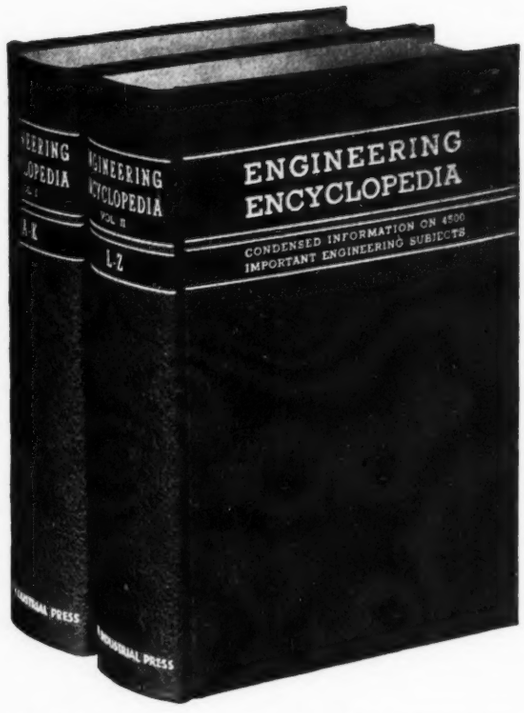

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- Is it true that copper hardening is a lost art?
- Which of the four American standard screw thread fits is recommended for most interchangeable screw threads?
- At what temperature is steel strongest?
- What does the octane number of a gasoline indicate?
- When is an electric motor in the fractional horsepower class?
- How much wind pressure per square foot is caused by a wind velocity of (a) 20 miles per hour? (b) 60 miles per hour?
- How is a hob designed for hobbing straight-sided splines?
- What are the distinguishing features of an Aero-thread?
- In wire classifications, what is (a) bright wire? (b) merchant wire? (c) market wire? (d) oil-tempered wire?

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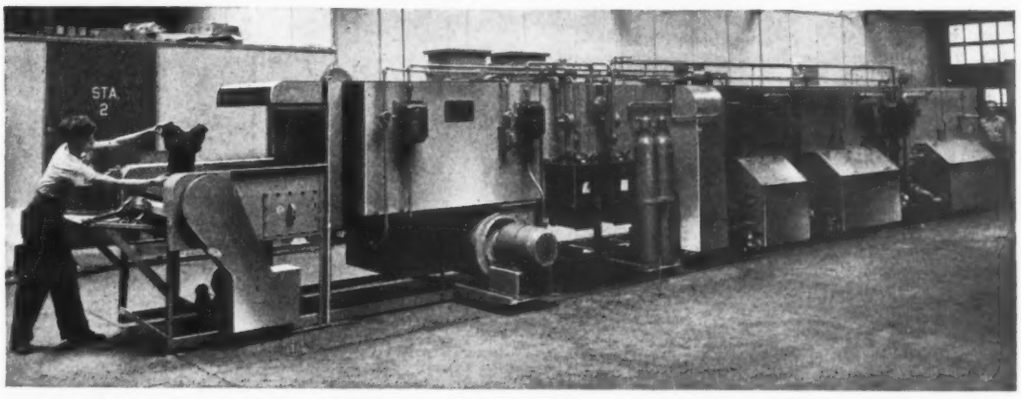

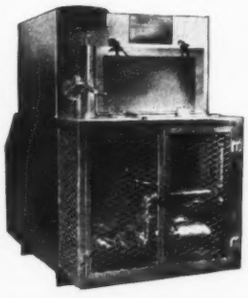

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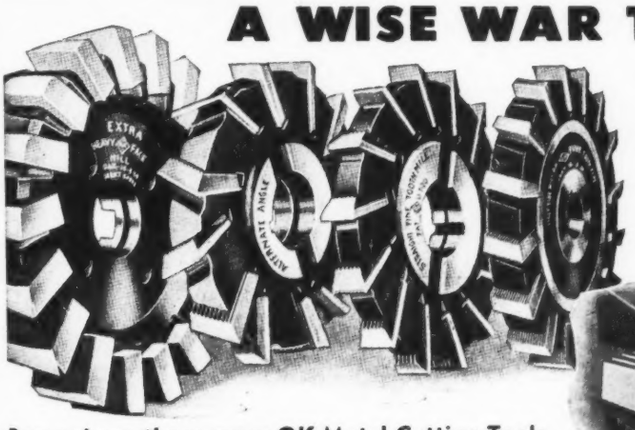

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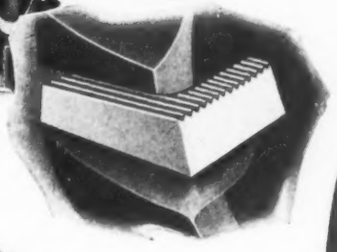

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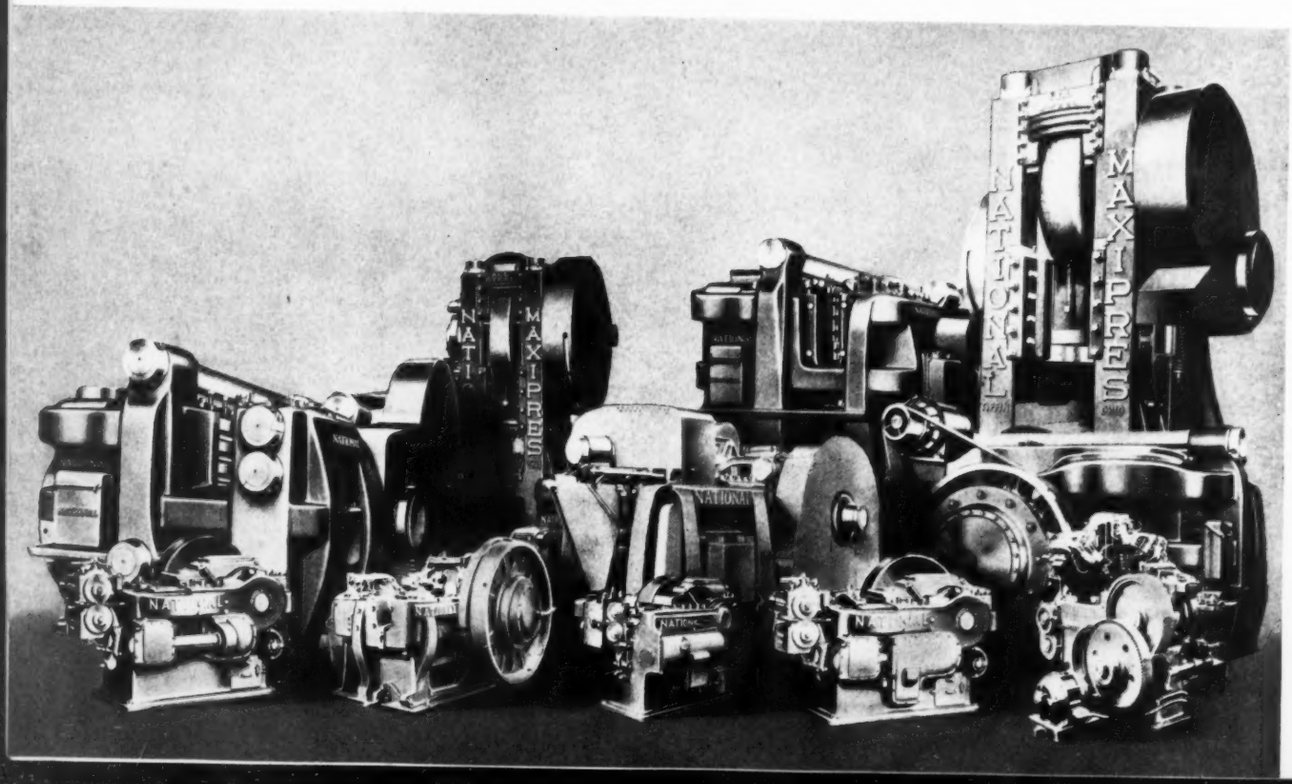

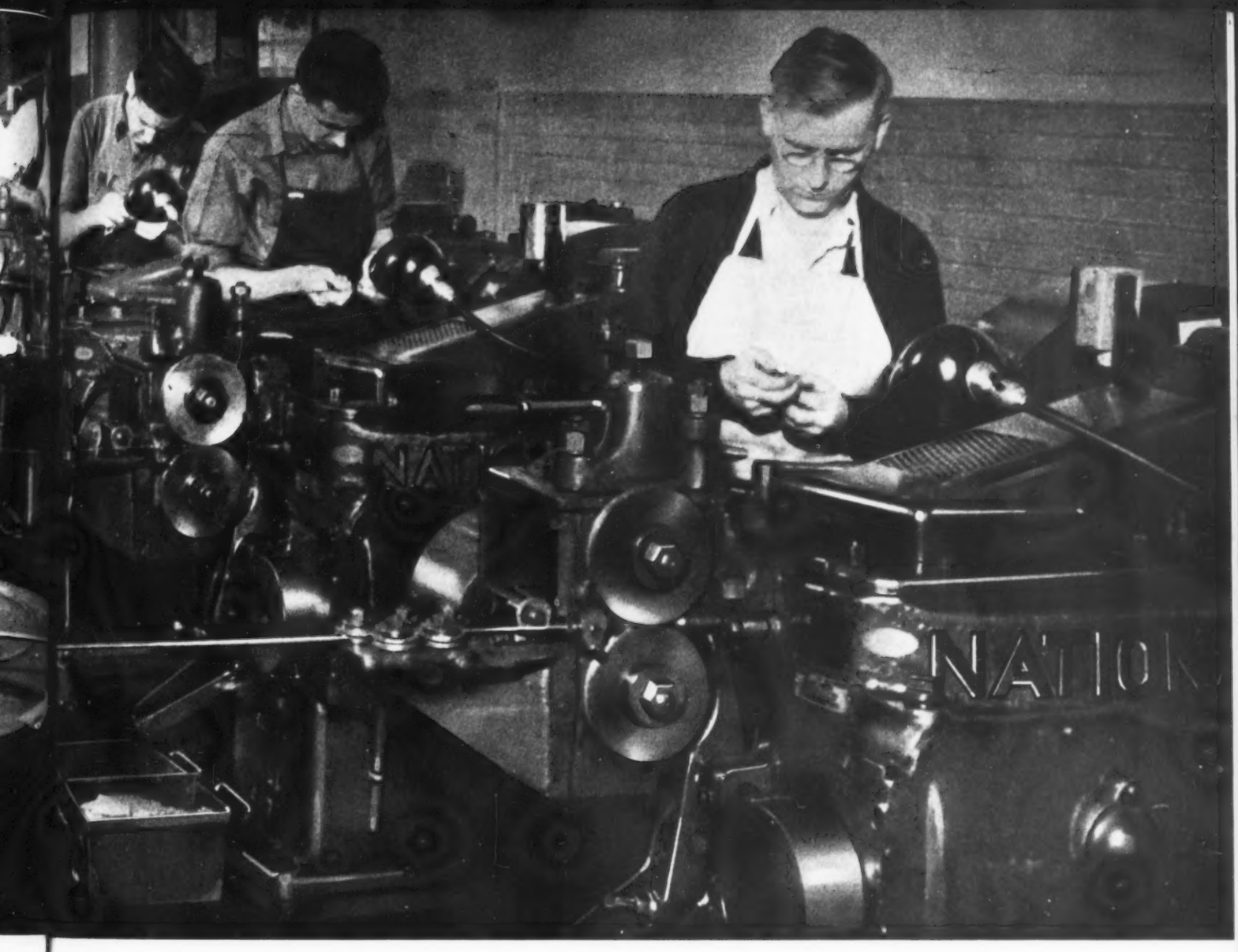

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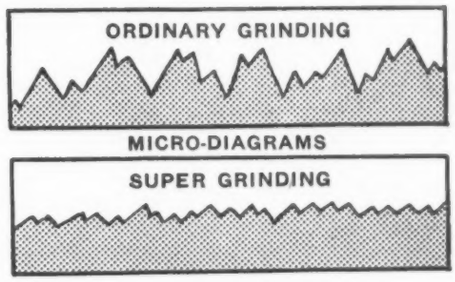

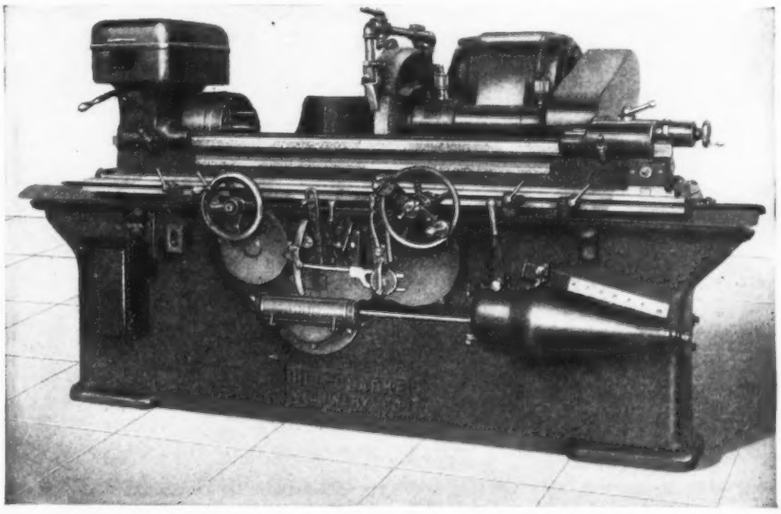

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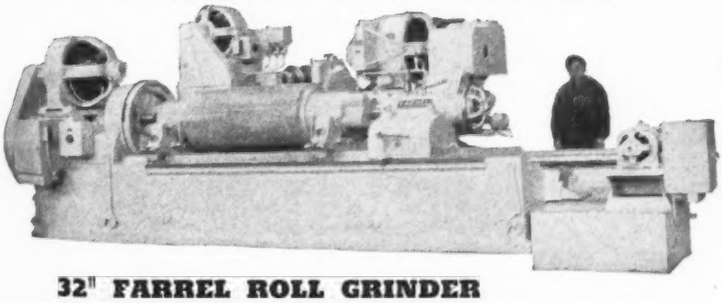
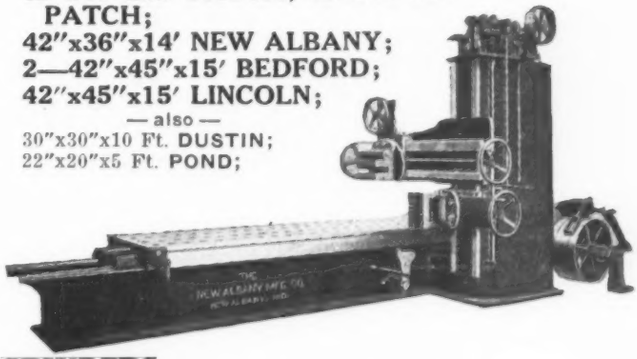


32" FARREL ROLL GRINDER

Will grind rolls up to maximum of 34" diameter; 30" grinding wheel; 10'6" between centers; with motors & controls.

OPENSIDE PLANERS

44"x38"x15 Ft. NEW ALBANY; M.D.
42"x40"x13' PATCH; 42"x42"x14' PATCH;
42"x36"x14' NEW ALBANY;
2—42"x45"x15' BEDFORD;
42"x45"x15' LINCOLN;
— also —
30"x30"x10 Ft. DUSTIN;
22"x20"x5 Ft. POND;



GRINDERS

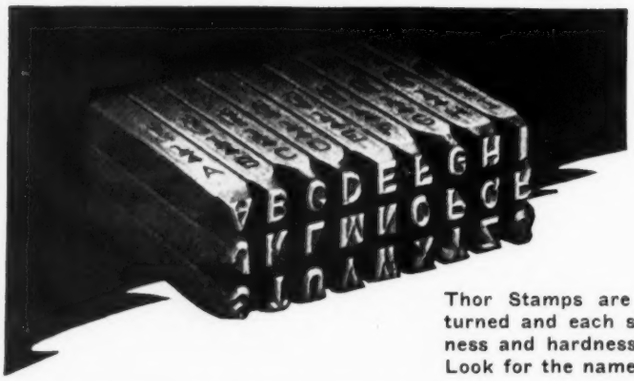
Cyl. 14"x72" NORTON; P.F.; Takes 2"x16" wheel;
10"x36" LANDIS; No. 22 LANDIS; 12" swing;
Disc No. 24 GARDNER VERTICAL SPINDLE HORIZONTAL B.B. 53" disc; Belt Drive;

MISCELLANEOUS ITEMS

800 Lb. BLISS BOARD DROP HAMMER;
No. 64 FELLOWS GEAR SHAPER;
No. 12 BARBER-COLMAN GEAR HOBBERS;
12" NEW HAVEN SLOTTER;
⅞" and 2½" Models A & B Cleveland Auto., Screw Machines; Snyder Two-Way Horizontal Boring, Reaming and Drilling Machine.

INTERSTATE MACHINERY CO., INC.

1451 W. PERSHING RD.
CHICAGO, ILLINOIS



Thor
STEEL STAMPS

Thor Stamps are made right. Characters are deeply cut, heads accurately turned and each stamp individually heat treated to the exact degree of toughness and hardness that gives the longest service — the most marks per dollar. Look for the name THOR and the BLUE HEAD on every stamp you buy.

THE PITTSBURGH STAMP COMPANY **810 Canal St., Pittsburgh, Pa.**

Classified and Re-Sale Section

Machinery Distributor and Salesman

Is this the opportunity you have been looking for?

If you are not subject to draft, and are over 30 years of age, with sufficient past experience in selling machinery to the metal working industry, we have a proposition that should interest you and make you a nice income.

Ours is a well established and fast growing machinery manufacturing business with representation in most of the principal American centers; at this time we are interested in adding to our sales organization several more distributors and a number of thoroughly experienced salesmen. Our machine sells to plants working on war materials. The price is upwards of $5000.00. We have complete research and engineering laboratories in which are being developed new type and essential equipment to meet post-war demands.

Write us giving a detailed outline of your past experience, both sales and practical, give names and types of machines you have sold, territory you have spent most of your recent years in, degree of past success, your age, married or single, condition of your health; all information will be treated strictly confidential and if your letter has convinced us that you are the man we are looking for, we shall contact you promptly. Address Box 895, care MACHINERY, 148 Lafayette St., New York, N. Y.

SPECIALS
READY TO RUN

8"—4-SPINDLE BULLARD
MULT-AU-MATIC
NEW IN 1929

NO. 1 FOOTE-BURT
DUPLEX SURFACE
BROACHING MACHINE
NEW IN 1934

THESE ARE WELL
BELOW CEILING PRICES

WIGGLESWORTH MACHINERY COMPANY
198 BENT ST., CAMBRIDGE, MASS.

WANTED

A Carl Zeiss toolmaker micrometer is urgently needed by a precision gage shop.

Write The Borg-Erickson Corporation, 469 East Ohio Street, Chicago.

WANTED—Mechanical Engineer

with extensive gear manufacturing experience for war plant. Wonderful opportunity for well qualified man. Write stating age, draft status, educational background, names and addresses of former employers. Box 892, MACHINERY, 148 Lafayette St., New York.

Priced for Prompt Disposal

Hor. hydraulic high pressure auto. brass die casting machine, area of platen 16" x 16" inside of 4 posts, max. slide adj. 23", also suitable for aluminum and magnesium; complete with full set of drawings, some patterns, also U. S. patent. Box No. 894, MACHINERY, 148 Lafayette St., New York.

TURRET LATHES
Goss & DeLeeuw, Model A, 6"x6¾"

MILLERS
No. 3 Wigglesworth (New)
No. 2 Knight Vertical
2" Pratt & Whitney Duplex Spline

GEAR MACHINERY
9" Pratt & Whitney Gear Grinder
Cimatool Gear Chamfering Machine, M.D.
11" Gleason Bevel Gear Generator

GRINDER
9" Pratt & Whitney Gear, M.D.

DRILLS
3'-9" Canedy-Otto radial
4-spindle Taylor & Fenn, M.D. (2)
B-16 Natco Multiple, M.D.

MISCELLANEOUS
8" Bullard Multimatic, M.D.
22"x22"x5' Whitcomb S-B Planer
36"x36"x8' Powell Planer Rev. M.D.
24"x24"x6' Whitcomb Planer
No. 303 Bliss Straight Side Press
No. 20 Waterbury-Farrel Thread Roller
No. 1 Foote-Burt Duplex Surface Broach
500 lb. Bradley Hammer
No. 21 S.A. Cochrane Bly Hi Speed Saw

WIGGLESWORTH MACHINERY COMPANY
198 Bent St., Cambridge, Mass.

FOR SALE

2—100 K.V.A. 60 Cycle Pittsburgh Transformers, 2300 volt primary 460-230 volt secondary Scott phase, changing Taps.

A number of Westinghouse 30-40 H.P. Type S Motors, Low Speeds.

VULCAN IRON WORKS, Wilkes Barre, Pa.

EXECUTIVE WANTED

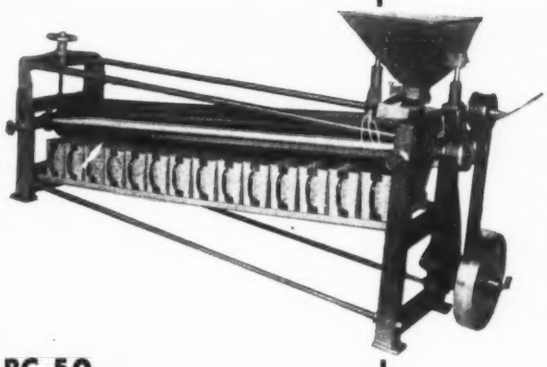
residing New York City who held key position in administration and sales management. Applicants aged 38 to 50. Mail handwritten replies to Box No. 893, care MACHINERY, 148 Lafayette St., New York, N. Y.

Do You Need Good Machinists, Draftsmen, Foremen?

Advertise for them in this classified section.

BARRY

Automatic Gauging Speeds War Production!



BC-50 GENERAL CLASSIFYING MACHINE

Ideal for gauging, grading or classifying small forgings, screw machine parts, etc. 1/3 H.P. motor gives economical operation. Fully equipped: $606.25.

Speed production by making gauging an automatic operation! The Barry Classifying Machine can be used for grading, gauging and classifying a wide range of parts as based on thickness or outer diameter. Accurately ground rolls, mounted so as to provide an angular adjustment give results to .001". Powered by a 1/3 H.P. motor, the Barry Classifying Machine is an efficient, low-cost solution to many problems. Write for details of how it is speeding production in ordnance plants, and how it can help you speed up your jobs.

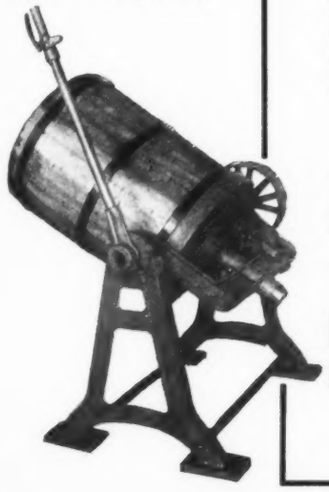
PROMPT DELIVERY!

BARRY COMPANY, INC.
MUSCATINE • IOWA
Sales Office: 9 South Clinton Street, Chicago, Ill.

HIGH SPEED ON HIGH-QUANTITY FINISHING!

WOODEN TUMBLING BARREL BC-21

Shown equipped for belt drive. May also be equipped with self-contained motor drive. Balanced design permits safe, easy control. $183.75.



Barry Tumbling Barrels are ideal for finishing operations on small castings, machined parts, balls, fuse components for the War Production program. Built in both wooden and metal types, and in sizes from 1 1/2 cubic feet capacity, they are capable of long service and dependable operation under severe conditions of wartime use.

PROMPT DELIVERY!

We are able to quote exceptionally prompt delivery on Barry Polishing and Tumbling Barrels. Write for complete specifications and delivery dates.

BARRY COMPANY, Inc.
MUSCATINE IOWA
Sales Office:
9 South Clinton Street, Chicago, Ill.

METAL TUMBLING BARREL BC-70

Built in four sizes 1½ to 5 cu. ft. Heavy, cast iron barrel, with or without inside ribs. Shown equipped for belt drive. May also be equipped with self-contained motor drive. $34.75 to $131.25.

PRODUCT INDEX

For location of advertisements of manufacturers listed, see alphabetical index, pages 409-410

ABRASIVE CLOTH AND PAPER
Abrasive Products, Inc., South Braintree, Mass.
Carborundum Co., Niagara Falls, N. Y.
Walls Sales Corp., 96 Warren St., New York.

ABRASIVE DISCS
Abrasive Products, Inc., South Braintree, Mass.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.

ABRASIVES, POLISHING
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ACCUMULATORS, HYDRAULIC
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Farquhar, A. B., Co., Ltd., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.

AIR HOISTS
See Hoists, Air.

AIR TOOLS
See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOY-STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disc Div.-Borg-Warner Corp. New Castle, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEEL, TUNGSTEN, VANADIUM, MANGANESE
Republic Steel Corp., Cleveland, O.

ALLOYS, MAGNESIUM
Dow Chemical Co., Midland, Mich.

ALLOYS, ZINC
National Lead Co., 111 Broadway, N. Y.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland.
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Davis Boring Tool Div., St. Louis, Mo.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jacobs Mfg. Co., Hartford, Conn.
Kempsmith Mch. Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

BABBITT
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co., Rockford, Ill.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Sundstrand Mch. Tool Co., Rockford, Ill.

BALLS, BRASS, STEEL, ETC.
Gwilliam Co., Brooklyn, N. Y.
S K F Industries, Inc., Philadelphia.
Waterbury Steel Ball Co., Inc., Poughkeepsie, N. Y.

BARS, BORING
See Boring Bars.

BARS, PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Phosphor Bronze Smelting Co., Philadelphia.

BARS, STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Jessop Steel Co., Washington, Pa.
LaSalle Steel Co., P. O. Box 6800 A., Chicago.
Monarch Steel Co., Indianapolis, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Wheelock, Lovejoy & Co., Cambridge, Mass.

BASES, MACHINERY, WELDED
Mahon, R. C., Co., Detroit, Mich.

BEARINGS, BABBITT
Bunting Brass & Bronze Co., Toledo, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland, O.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, BALL
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Inc., Poughkeepsie, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N Y.
McGill Manufacturing Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
S K F Industries, Inc., Philadelphia.
Torrington Co., Torrington, Conn.

BEARINGS, BRONZE AND SPECIAL ALLOY
Ampco Metal, Inc., Milwaukee, Wis.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Bunting Brass & Bronze Co., Toledo, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, LINESHAFT
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland, O.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.

Eliminate Hardening Distortion

Drill AFTER HARDENING with "HARDSTEEL" Drills

Wherever distortion during hardening of drilled steel parts throws drilled holes out of round or out of line—change your shop practice. Harden the part—then drill with "HARDSTEEL" without annealing, as is being done on the airplane crankshaft illustrated. Speed up your drilling—cut your rejects—insure perfect matching at assembly.

"HARDSTEEL" drills work with ease in steels hardened by any process and also the work hardening types. The harder the material—the easier it is to drill, countersink and counterbore.

"HARDSTEEL" grinds quickly on any ordinary wheel—saves time—and drills can be reground many times.

Learn all about the drilling of hardened steels and steel parts. Ask for the "HARDSTEEL" operator's manual—no charge.

BLACK DRILL CO. • 5005 Euclid Ave., Cleveland, O.

YOU HARDEN IT—WE'LL DRILL IT

"HARDSTEEL"

DRILLS · REAMERS · TOOL BITS · SPECIAL TOOLS

Roller Bearing Co. of America, Trenton, N. J.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, NEEDLE

Bantam Bearings Corp., South Bend, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, ROLLER

Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia.
Timken Roller Bearing Co., Canton, O.

BEARINGS, SELF-LUBRICATING (OILLESS)

Arguto Oilless Bearing Co., Wayne Jct., Philadelphia.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

BEARINGS, TAPERED ROLLER

Bantam Bearings Corp., South Bend, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Timken Roller Bearing Co., Canton, O.

BEARINGS, THRUST

Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hill Acme Co., Cleveland, O.
McGill Manufacturing Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
S K F Industries, Inc., Philadelphia.
Timken Roller Bearing Co., Canton, O.

BELT DRIVES, MULTIPLE VEE

Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.

BELT FASTENERS, METAL, LEATHER, ETC.

Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

BELT SHIFTERS

LeBlond, R. K., Mch. Tool Co., Cincinnati.
Ready Tool Co., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION

Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.

BENCHES, WORK, AND BENCH LEGS

Baumbach, E. A., Mfg. Co., 810 S. Kilbourn Ave., Chicago.
Hill Acme Co., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, ANGLE IRON

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Wallace Supplies Mfg. Co., 1310 Diversey Parkway, Chicago, Ill.

BENDING MACHINES, HYDRAULIC

Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Wallace Supplies Mfg. Co., 1310 Diversey Parkway, Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING MACHINES, PIPE

Farquhar, A. B., Co., Ltd., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Wallace Supplies Mfg. Co., 1310 Diversey Parkway, Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.
Production Machine Co., Greenfield, Mass.
Walls Sales Corp., 96 Warren St., New York.

BLOCKS, CHAIN—See Hoists, etc.

BLOWERS

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BLUEPRINT MACHINERY AND ACCESSORIES

Wickes Brothers, Saginaw, Mich.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

BOLT AND NUT MACHINERY

Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Denison Engineering Co., Columbus, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
National Machinery Co., Tiffin, O.
Oster Manufacturing Co., Cleveland, O.

BOLTS AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
National Acme Co., Cleveland.

BOOKS, TECHNICAL

Industrial Press, 148 Lafayette St., New York.
Lincoln Electric Co., Cleveland, O.

BORING AND DRILLING MACHINES, VERTICAL

Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Bullard Company, Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland.
Gorton, George, Mch. Co., Racine, Wis.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Sellers, Wm., & Co., Inc., Philadelphia.

BORING AND TURNING MILLS, VERTICAL

Bullard Company, Bridgeport, Conn.
Cincinnati Planer Co., Cincinnati.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Rogers Machine Works, Inc., Alfred, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia.

BORING BARS

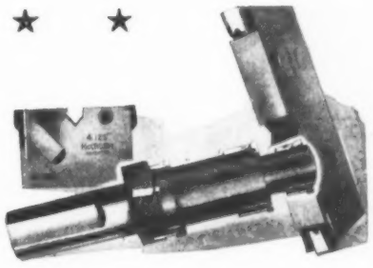
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Inc., Detroit.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.
McCrosky Tool Corp., Meadville, Pa.
Ready Tool Co., Bridgeport, Conn.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

BORING, DRILLING AND MILLING MACHINES, HORIZONTAL

Barnes, W. F. & John, Co., Rockford, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Lucas Mch. Tool Co., Cleveland.
Moline Tool Co., Moline, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.
Sommer & Adams Co., Cleveland, O.
Universal Boring Machine Co., Hudson, Mass.

★ ★ ★ ★ ★ ★ ★

Doing their Part in Wartime Production



McCROSKY Block-Type Boring Tools are engineered to save time and material. An improved centralizing device insures accurate centralization of the block in the bar. Cutter blocks can be removed without removing the centering key. A thrust screw behind each blade provides quick and sensitive adjustment. And positive blade lock is provided by McCrosky's tested pin-and-screw lock. ★

Full Details in McCrosky Bulletin 16-B.

BORING HEADS
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Gairing Tool Co., Detroit.
McCrosky Tool Corp., Meadville, Pa.

BORING HEADS, OFFSET
Gairing Tool Co., Detroit.

BORING MACHINES, DIAMOND AND CARBIDE TOOL
Ex-Cell-O Corporation, Detroit.
Heald Machine Co., Worcester, Mass.
Stokerunit Corp., Milwaukee, Wis.

BORING MACHINES, JIG
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cleereman Machine Tool Co., Green Bay, Wis.
De Vlieg Machine Co., Ferndale, Mich.
Fosdick Machine Tool Co., Cincinnati, O.
Kearney & Trecker Products Corp., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Calif.
Moore Special Tool Co., Inc., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.

BORING TOOLS
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Carboloy Co., Inc., Detroit.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Mch. Co., Madison, Wis.
Haynes Stellite Co., Kokomo, Ind.
Jones & Lamson Mch. Co., Springfield, Vt.
McCrosky Hool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
O. K. Tool Co., Inc., Shelton, Conn.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Ready Tool Co., Bridgeport, Conn.
Slocomb, J. T. Co., Providence, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., No. Chicago, Ill.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

BRAKES, PRESS AND BENDING
Cincinnati Shaper Co., Cincinnati.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
Watson-Stillman Co., Roselle, N. J.

BROACHES
American Broach & Mch. Co., Ann Arbor, Mich.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Carboloy Co., Inc., Detroit.
Detroit Broach Co., Detroit, Mich.
Ex-Cell-O Corporation, Detroit.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Lapointe Machine Tool Co., Hudson, Mass.

BROACHING MACHINES
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland.
Lapointe Machine Tool Co., Hudson, Mass.

BRONZE
Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Jefferson Machine Tool Co., Cincinnati, O.
Johnson Bronze Co., New Castle, Pa.
Phosphor Bronze Smelting Co., Philadelphia.

BUFFERS
Delta Mfg. Co., Milwaukee, Wis.
Gardner Mfg. Co., Beloit, Wis.
Production Machine Co., Greenfield, Mass.
Rotor Tool Co., Cleveland, O.
United States Electrical Tool Co., Cincinnati, O.

BUFFERS (FLEXIBLE SHAFT)
Stow Mfg. Co., Binghamton, N. Y.

BULLDOZERS
Baldwin-Southwark Corp., Philadelphia, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Lake Erie Engineering Corp., Buffalo, N. Y.
National Machinery Co., Tiffin, O.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.

BURNISHING MACHINERY
Baird Machine Co., Bridgeport, Conn.

BUSHINGS, BRASS, BRONZE, ETC.
Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.

BUSHINGS, HARDENED
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Leland-Gifford Co., Worcester, Mass.
U. S. Tool Company, Inc., Ampere, N. J.

BUSHINGS, JIG
Ampco Metal, Inc., Milwaukee, Wis.
Ex-Cell-O Corporation, Detroit.
Universal Engineering Co., Frankenmuth, Mich.

CABINETS, TOOL
Armstrong Brothers Tool Co., 313 No. Francisco Ave., Chicago.

CALIPERS
Brown & Sharpe Mfg. Co., Providence.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Starrett, L. S., Co., Athol, Mass.

CAM CUTTING MACHINES
Frew Machine Co., Philadelphia.
Pratt & Whitney Co., West Hartford, Conn.

CAM MILLING AND GRINDING MACHINES
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence (Screw Machines).
Hartford Special Mchry Co., Hartford, Conn.
Kux Machine Co., 3930-44 W. Harrison St., Chicago.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDE, TANTALUM, TITANIUM AND TUNGSTEN
Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Vanadium Alloys Steel Co., Latrobe, Pa.
Vascoloy-Ramet Corp., No. Chicago, Ill.

CASE-HARDENING
Pittsburgh Gear & Machine Co., Pittsburgh, Pa.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

CASE-HARDENING FURNACES
See Furnaces, Heat Treating.

CASTINGS, BRASS, BRONZE AND ALUMINUM
Ampco Metal, Inc., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa. (Brass and Bronze only).
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries, Div., Philadelphia, Pa.
Howard Foundry Co., 4900 Bloomingdale Rd., Chicago. (also Magnesium)
Jefferson Machine Tool Co., Cincinnati, O.

CASTINGS, DIE
Madison-Kipp Corporation, Madison, Wis.
Veeder-Root, Inc., Hartford, Conn.

CASTINGS, GRAY IRON
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence.

CASTINGS, STEEL, ALLOY, ETC.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

CEMENT, DISC GRINDING WHEEL
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Gardner Machine Co., Beloit, Wis.
Walls Sales Corp., 96 Warren St., New York.

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Consolidated Mch. Tool Corp., Rochester, N. Y.

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CENTERS, LATHES

Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Modern Machine Corp., Brooklyn, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Ready Tool Co., Bridgeport, Conn.
Standard Tool Co., Cleveland, O.
Vascoloy-Ramet Corp., No. Chicago, Ill.

CENTERS, PLANER AND MILLER

Cincinnati Planer Co., Cincinnati.

CHAIN BLOCKS

See Hoists, Chain, etc.

CHAIN DRIVES

Morse Chain Co., Ithaca, N. Y.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHAINS, POWER TRANSMISSION AND CONVEYOR

Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHAINS, STEEL

Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CHAMFERING MACHINES, GEAR TOOTH

Bilgram Gear & Mch. Works, Philadelphia.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit, Mich.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Lipe-Rollway Corporation, Syracuse, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

CHISELS AND CHISEL BLANKS, PNEUMATIC HAMMER

Bethlehem Steel Co., Bethlehem, Pa.

CHUCKING MACHINES

Bardons & Oliver, Inc., Cleveland, O.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bullard Company, Bridgeport, Conn.
Cleveland Automatic Machine Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Goss & De Leeuw Mach. Co., New Britain, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
National Acme Co., Cleveland.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Sundstrand Mch. Tool Co., Rockford, Ill.
Warner & Swasey Co., Cleveland.

CHUCKING MACHINES, MULTIPLE SPINDLE

Goss & De Leeuw Mch. Co., New Britain, Conn.
National Acme Co., Cleveland.

CHUCKS, AIR-OPERATED

Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.

CHUCKS, COLLET OR SPLIT

See Collets.

CHUCKS DIAPHRAGM

Van Norman Mch. Tool Co., Springfield, Mass.

CHUCKS, DRILL

Cleveland Twist Drill Co., Cleveland.
Ettco Tool Co., Brooklyn, N. Y.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Standard Tool Co., Cleveland, O.

CHUCKS, FULL FLOATING

Errington Mechanical Laboratory, 200 Broadway, New York
Gisholt Mch. Co., Madison, Wis.

CHUCKS, LATHES, ETC.

Bullard Company, Bridgeport, Conn.
Cushman Chuck Co., Hartford, Conn.
Gisholt Mch. Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Warner & Swasey Co., Cleveland.

CHUCKS, MAGNETIC

Arter Grinding Machine Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, QUICK CHANGE AND SAFETY

Errington Mechanical Laboratory, 200 Broadway, New York.
Jarvis, Chas. L., Co., Middletown, Conn.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

CHUCKS, RING WHEEL

Gardner Machine Co., Beloit, Wis.

CHUCKS, TAPPING

Barber-Colman Co., Rockford, Ill.
Errington Mechanical Laboratory, 200 Broadway, New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.

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Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

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Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Danly Machine Specialties, Inc., 2112 So. 52nd Ave., Chicago.
Starrett, L. S., Co., Athol, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York.

CLEANERS, CHEMICAL, FOR METAL

Bullard Co., Bullard-Dunn Process Div., Bridgeport, Conn.
Magnus Chemical Co., Garwood, N. J.
Oakite Products Inc., 26 Thames St., New York.

CLUTCHES

Barnes Drill Co., Rockford, Ill.
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Dodge Mfg. Corp., Mishawaka, Ind.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Hilliard Corp., Elmira, N. Y.
Lipe-Rollway Corporation, Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Rockford Drilling Mch. Div., Rockford, Ill.
Twin Disc Clutch Co., Racine, Wis.

COATINGS, PROTECTIVE

Bullard Co., Bullard-Dunn Process Div., Bridgeport, Conn.

COLLARS, SAFETY

Hill Acme Co., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Ames, B. C., Co., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland.
Gisholt Mch. Co., Madison, Wis.
Hanniffin Mfg. Co., 621-631 S. Kolmar Ave., Chicago.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Wks., Rochester, N. Y.
Precision Collet Co., 265 Canal St., New York.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland.

COMPARATORS—See Gages Comparator.

COMPARATORS, SCREW THREAD

Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 126 Lafayette St., New York.

COMPOUNDS, CLEANING

Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.

COMPOUNDS, CUTTING, GRINDING, METAL DRAWING, ETC.

Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 East 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, RESIN OR MOLDING

General Electric Co., Schenectady, N. Y.

CONTRACT WORK

Berger Mfg. Co., Bridgeport, Conn.
Columbus Die, Tool & Mch. Co., Columbus, O.
Diefendorf Gear Corp., Syracuse, N. Y.
Ex-Cell-O Corp., Detroit.
Hartford Special Mchry. Co., Hartford, Conn.
Hill Acme Co., Cleveland, O.
Jefferson Machine Tobl Co., Cincinnati, O.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lees-Bradner Co., Cleveland.
Modern Mch. Corp., 323 Berry St., Brooklyn, N. Y.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., Cleveland.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Taylor-Shantz, Inc., Rochester, N. Y.
U. S. Tool Company, Inc., Ampere, N. J.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

COUNTERBORES

Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Haynes Stellite Co., Kokomo, Ind.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Starrett, L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., North Chicago, Ill.

COUNTERSHAFTS

Hill Acme Co., Cleveland, O.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Standard Pressed Steel Co., Jenkintown, Pa.
Warner & Swasey Co., Cleveland.

COUNTERSINKS

Ex-Cell-O Corporation, Detroit.
Gairing Tool Co., Detroit.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

COUNTERS, REVOLUTION

Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.
Veeder-Root, Inc., Hartford, Conn.

COUNTING DEVICES

Starret, L. S., Co., Athol, Mass.
Veeder-Root, Inc., Hartford, Conn.

COUPLINGS, FLEXIBLE

Atlantic Gear Works, Inc., 200 Lafayette St., New York.
Baldor Electric Co., St. Louis, Mo.
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

COUPLINGS, SHAFT

Brown Engineering Co., 131 N. Third St., Reading, Pa.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Hilliard Corp., Elmira, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, ELECTRIC TRAVELING

Morgan Engineering Co., Alliance, O.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

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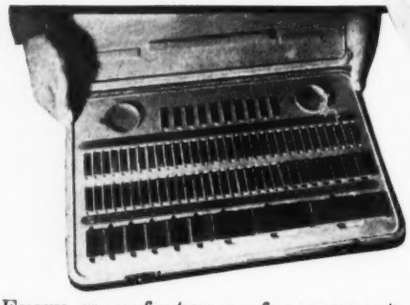

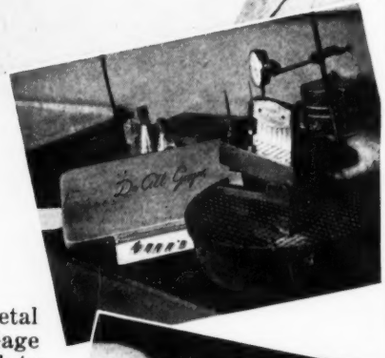

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CRANES, LOCOMOTIVE
Cullen-Friestedt Co., 1305 S. Kilbourn Ave., Chicago.

CRANES, PORTABLE
Hill Acme Co., Cleveland, O.

CRANK PIN TURNING MACHINES
Pedrick Tool & Mch. Co., Philadelphia, Pa.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, etc.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Ex-Cell-O Corporation, Detroit.
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago. (Gear Shaper).
Michigan Tool Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
O.K. Tool Co., Inc., Shelton, Conn.
Pratt & Whitney Co., West Hartford, Conn.
Slocomb, J. T., Co., Providence, R. I.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Waltham, Mass.

CUTTERS, MILLING
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Carboloy Co., Inc., Detroit.
Columbus Die, Tool & Machine Co., Columbus, O.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gammons-Hoaglund Co., Manchester, Conn.
Genesee Tool Co., Fenton, Mich.
Gorton, George, Mch. Co., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Kearney & Trecker Corp., Milwaukee, Wis.
Machinists Tool Grinding Co., 2834 W. Lake St., Chicago.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit, Mich.
Modern Tool Wks., Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
O.K. Tool Co., Inc., Shelton, Conn.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Slocomb, J. T., Co., Providence, R. I.
Sommer & Adams Co., Cleveland, O.
Sossner, Inc., New York, N. Y.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
U. S. Machine Tool Mfg. Corp., Terre Haute, Ind.
Vascoloy-Ramet Corp., No. Chicago, Ill.
Whitney Chain & Mfg. Co., Hartford, Conn. (For Woodruff Keys).

CUTTERS, RECONDITIONING
See Tool Reconditioning.

CUTTING COMPOUNDS
See Compounds, Cutting, Grinding, etc.

CUTTING-OFF MACHINES
Avey Drilling Machine Co., Cincinnati.
Bardons & Oliver, Inc., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Mch. Tool Co., Jackson, Mich. (Lathe Type for Tubing).
Peerless Machine Co., Racine, Wis.

CUTTING-OFF MACHINES, ABRASIVE WHEEL
Armstrong Brothers Tool Co., 313 N. Francisco, Ave., Chicago.
Delta Mfg. Co., Milwaukee, Wis.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

CUTTING-OFF MACHINES, COLD SAW
See Sawing Machines, Circular.

CUTTING-OFF TOOLS
Armstrong Brothers Tool Co., 313 N. Francisco, Ave., Chicago.
Carbide Fabricators Co., Royal Oak, Mich.
Empire Tool Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Luers, J. Milton, Mount Clemens, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Vascoloy-Ramet Corp., North Chicago, Ill.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

CUTTING-OFF TOOLS, CIRCULAR
Brown & Sharpe Mfg. Co., Providence.

CUTTING-OFF WHEELS, ABRASIVE
Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

CYLINDER BORING MACHINES
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., Detroit.
Moline Tool Co., Moline, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

CYLINDERS, HYDRAULIC
American Hollow Boring Co., Erie, Pa.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Denison Engineering Co., Columbus, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Hydraulic Products Co., 525 W. 76th St., Chicago.
Logansport Machine, Inc., Logansport, Ind.

CYLINDERS, PNEUMATIC
Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Clearing Mch. Corp., 6499 W. 65th St., Chicago.
Hanna Engineering Works, 1765 Elson Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Products Co., 525 W. 76th St., Chicago.

DEALERS, MACHINERY
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Earle Gear & Mch. Co., Philadelphia.
Hill Clarke Machinery Co., 649 Washington Blvd., Chicago.
Interstate Machinery Co., Chicago, Ill.
Jefferson Machine Tool Co., Cincinnati, O.
Motch & Merryweather Mchy. Co., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Simmons Machine Tool Corp., Albany, N. Y.

DEMAGNETIZERS
Blanchard Mch. Co., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

DESIGNERS, MACHINE AND TOOL
Bayard, M. L., & Co., Philadelphia, Pa.
Ex-Cell-O Corp., Detroit.
Hartford Special Mchry. Co., Hartford, Conn.
Hecker, A. W., Cleveland, O.
Ruthman Mchry. Co., Cincinnati.

DIAMONDS AND DIAMOND TOOLS
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., 938 E. 41st St., Chicago, Ill.
Smit, J. K., & Co., 157 Chambers St., New York.

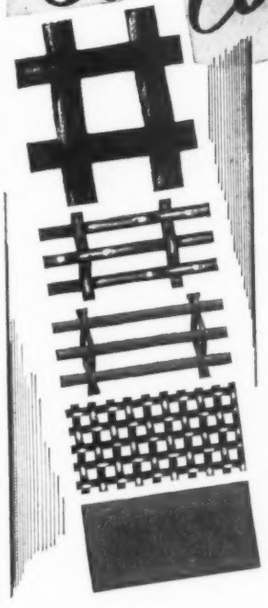
DIE CASTING MACHINES
Kux Machine Co., 3930-44 W. Harrison St., Chicago.
Madison-Kipp Corp., Madison, Wis.
Reed-Prentice Corp., Worcester, Mass.

DIE CASTINGS
See Castings, Die.

DIE CUSHIONS, PNEUMATIC
Clearing Mch. Corp., 6499 W. 65th St., Chicago.

Of Course you can get

WIRE CLOTH IMMEDIATELY!



Countless rolls and pieces of "Buffalo" industrial wire cloth are regularly stocked for immediate shipment. Frequently, you can fill your requirements from these stocked items and save weeks from delivery dates of specially woven cloths.

How can you keep posted on what's currently stocked? Buffalo Wire Works publishes and mails monthly an attractive Stock List showing a wide variety of lengths, widths and grades available at once. This is a free service—no obligation. Send your name, title, company and address today and you will be promptly placed on the mailing list.

Material from stock is cut to any desired length. Complete production services include trimming, die cutting, welding, soldering, binding and fabricating into finished products.

AVAILABLE AT ONCE ON PRIORITY
1000 ft.
COMMERCIAL BRONZE
24 in. wide
2x2 mesh
18 W&M gauge

Whatever you may require in wire cloth, not listed in the Stock List, can be woven to order.

FREE STOCK LIST
Mailed Monthly
On Request.

DOING BUSINESS FROM COAST TO COAST FOR 74 YEARS

Buffalo WIRE WORKS CO., INC.
ESTABLISHED 1869 AS SCHEELER'S SONS

445 TERRACE BUFFALO, N.Y.

DIE INSERTS, CARBIDE
Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIE MAKERS' SUPPLIES
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

DIE MAKING MACHINES
Grob Brothers, Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., Adrian, Mich.
Peerless Machine Co., Racine, Wis.

DIE SETS, STANDARD
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.

DIE SINKING MACHINES
Cincinnati Milling Mch. Co., Cincinnati.
Gorton, George, Mch. Co., Racine, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIE SINKING PRESSES
Baldwin-Southwark Corp., Philadelphia, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS
See Stocks, Die.

DIES, LETTERING AND EMBOSSING
Noble & Westbrook Mfg. Co., Hartford, Conn.

DIES, SHEET METAL, ETC.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Columbus Die, Tool & Mch. Co., Columbus, O.
Modern Machine Corp., Brooklyn, N. Y.
Niagara Mch. & Tool Wks., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., Detroit, Mich.
Ruthman Mchry. Co., Cincinnati, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.
Whistler, S. B., & Sons, Inc., Buffalo, N. Y.

DIES, THREADING
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Butterfield Div. Union Twist Drill Co., Derbey Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.

DIES, THREADING, OPENING
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Wks., Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Oster Manufacturing Co., Cleveland, O.

DIES, THREAD ROLLING
Hanson-Whitney Mch. Co., Hartford, Conn.
Pratt & Whitney Co., West Hartford, Conn.

DISCS, ABRASIVE
Abrasive Co., Bridesburg, Philadelphia, Pa.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Gardner Mch. Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Walls Sales Corp., 96 Warren St., New York.

DIVIDING HEADS
See Index Centers.

DOWEL PINS
Allen Mfg. Co., Hartford, Conn.
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Mch. Specialties, Inc., 2112 S. 52nd Ave., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

DRAFTING MACHINES
Universal Drafting Machine Co., Cleveland, O.

DRAWING BOARDS AND TABLES
Universal Drafting Machine Co., Cleveland, O.

DRESSERS, GRINDING WHEEL
Carboloy Co., Inc., Detroit.
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., 938 East 41st St., Chicago.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Smit, J. K., & Co., 157 Chambers St., New York.
Standard Tool Co., Cleveland, O.
Vinco Corporation, Detroit, Mich.

DRIFTS, DRILL
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Standard Tool Co., Cleveland, O.

DRILL HEADS, MULTIPLE
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Buhr Machine Tool Co., Ann Arbor, Mich.
Delta Mfg. Co., Milwaukee, Wis.
Errington Mechanical Laboratory, 200 Broadway, New York.
Ettco Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit.
Moline Tool Co., Moline, Ill.

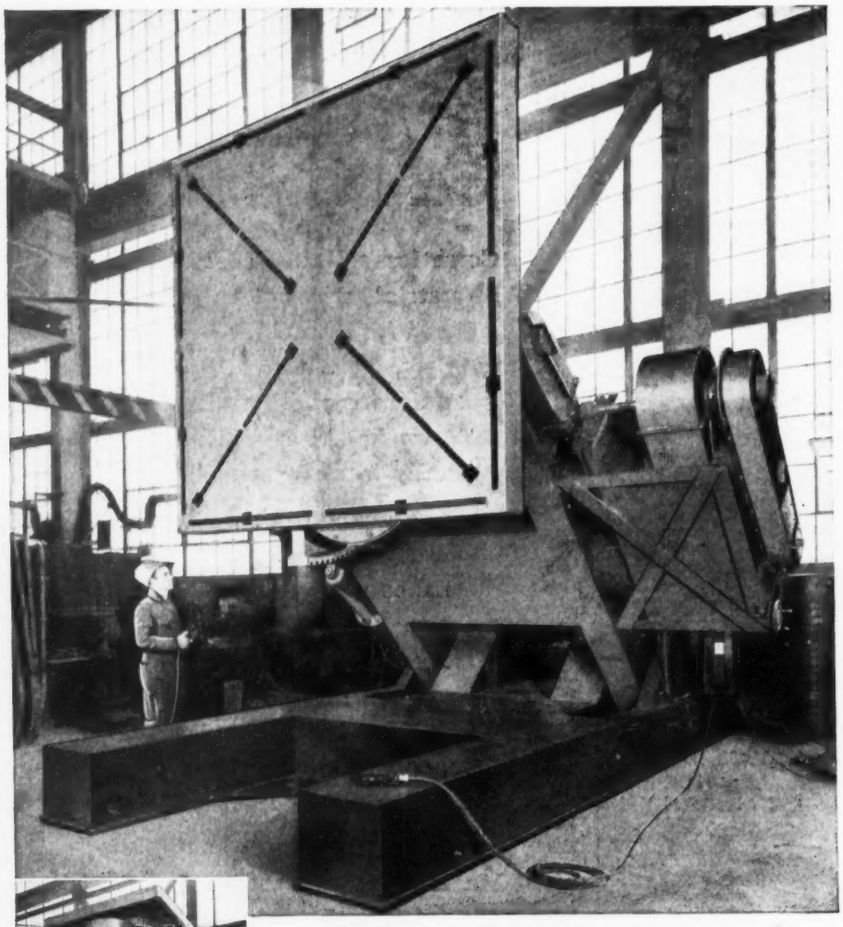
DRILL SOCKETS
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

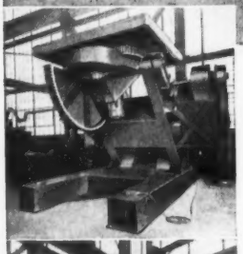
DRILL SPEEDERS
Graham Mfg. Co., Inc., E. Greenwich, R. I.

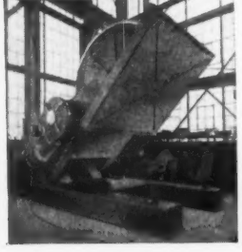
DRILL STANDS
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
United States Electrical Tool Co., Cincinnati.

DRILLING MACHINES, AUTOMATIC
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.

DRILLING MACHINES, BENCH
Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Delta Mfg. Co., Milwaukee, Wis.
Dumore Co., Racine, Wis.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Fosdick Machine Tool Co., Cincinnati, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.







Today's Specifications read:

"MUST BE POSITION WELDED"

To guarantee flawless welds, stronger unions and smoother, cleaner fillets, buyers of welded products today specify, "must be position welded."

The greatest advance in welding technique, position welding, not only assures a better product but reduces spoilage and rejects, cuts actual welding time by permitting the use of larger rods, and cuts crane, crane crew and welders handling and set-up time to a fraction. *On a C-F Positioner weldments and assemblies can be welded down-hand on ALL sides with a single set-up;* can be revolved completely around and tilted to any point up to 135° from horizontal. C-F Positioners come in capacities from small hand operated positioners to large variable speed giants that twist and turn 30,000 lb. weldments under push button control.

Write for Bulletin WP 22.

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Production Machine Co., Greenfield, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Foote-Burt Co., Cleveland.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, GANG

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Production Machine Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Conn.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, HORIZONTAL DUPLEX

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes, W. F., & John, Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee, Wis.
Frew Machine Co., Philadelphia.
Kingsbury Mch. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Mch. & Tool Co., Detroit.
Sundstrand Mch. Tool Co., Rockford, Ill.

DRILLING MACHINES, INVERTED

Barnes Drill Co., Rockford, Ill.

DRILLING MACHINES, MULTIPLE, CENTER COLUMN TYPE

Barnes Drill Co., Rockford, Ill.

DRILLING MACHINES, MULTIPLE SPINDLE

Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland.
Fosdick Machine Tool Co., Cincinnati, O.
Greenlee Bros. & Co., Rockford, Ill.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Pratt & Whitney Co., West Hartford, Conn.
Production Mch. Co., Greenfield, Mass.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, RADIAL

American Tool Wks. Co., Cincinnati.
Carlton Machine Tool Co., Cincinnati.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Foote-Burt Co., Cleveland, O.
Fosdick Machine Tool Co., Cincinnati, O.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, RAIL

See Drilling Machines, Gang.

DRILLING MACHINES, SENSITIVE

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland, O.
Fosdick Machine Tool Co., Cincinnati, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Pratt & Whitney Co., West Hartford, Conn.
Production Mch. Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

DRILLING MACHINES, UPRIGHT

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Duro Metal Products Co., 2649 N. Kildare Ave., Chicago.
Foote-Burt Co., Cleveland, O.
Fosdick Machine Tool Co., Cincinnati, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Production Mch. Co., Greenfield, Mass.
Producto Machine Co., Bridgeport, Conn.
Rehnberg-Jacobson Mfg. Co., Rockford, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Sellers, Wm., & Co., Inc., Philadelphia.

DRILLING MACHINES, WALL RADIAL

Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, CENTER

Cleveland Twist Drill Co., Cleveland.
Gairing Tool Co., Detroit.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Slocomb, J. T., Co., Providence, R. I.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland.

DRILLS, CORE

Carboloy Co., Inc., Detroit.
Ex-Cell-O Corp., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Haynes Stellite Co., Kokomo, Ind.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, PORTABLE ELECTRIC

Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
United States Electrical Tool Co., Cincinnati.

DRILLS, PORTABLE PNEUMATIC

Rotor Tool Co., Cleveland, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.

DRILLS, RATCHET

Armstrong Bros., Tool Co., 313 N. Francisco, Ave. Chicago.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, TWIST

Black Drill Co., Cleveland, O.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRILLS, WIRE

Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

DRIVES, MOTORIZED BELT

Cullman Wheel Co., 1339 Altgeld St., Chicago.
Turner Uni-Drive Co., Kansas City, Mo.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

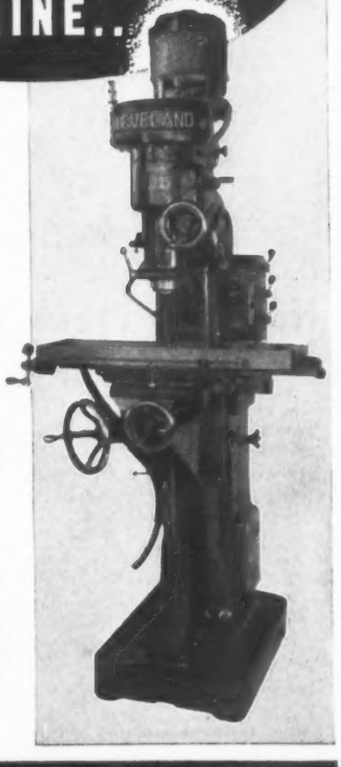
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

ELEVATING TABLES, HYDRAULIC

Lyon-Raymond Corp., Greene, N. Y.

DESIGNED TO FILL AN *Expressed* NEED—

THE *Cleveland* NO. 1 VERTICAL MILLING MACHINE..



The wide welcome it has received shows that the Cleveland No. 1 Vertical Milling Machine has indeed filled a definite need. Modern production plants, tool rooms, and mold shops evidently wanted these features:

(1) Big, husky spindle of chrome nickel steel heat-treated and mounted on 200-lb. pre-loaded precision bearings.
(2) All lead screws and feed gears mounted on Timken bearings for smooth, quiet running and longer life.
(3) Overload protection on all motors to prevent motor failure and resultant production breaks.
(4) Ample coolant sump in base. (Pump optional.)
(5) Hand wheel and lead screw on spindle head for quick shifting of belts for changes of spindle speeds.
(6) 12 feeds and 12 speeds to broaden range.

Longitudinal feed, 18"; cross travel, 8-1/2"; vertical travel, 16". Table working surface, 8"x 32". Cutter capacity, 1/16" to 2-1/2" mills. Spindle speed, 100 r.p.m. to 1800 r.p.m.

The "Cleveland No. 1" gives you great speed and power, combined with strength, rigidity and accuracy. It excels on continuous heavy duty production.

Ask for Sommer & Adams Bulletin "M"

THE SOMMER & ADAMS COMPANY
18511 EUCLID AVENUE • CLEVELAND, OHIO
Custom-Built EQUIPMENT FOR MANY PURPOSES

Reasonably prompt delivery can now be made to those holding the necessary priorities.

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See Grinding Wheels
EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.
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Gorton, George, Mch. Co., Racine, Wis.
United States Electrical Tool Co., Cincinnati.
EXTRACTORS, SCREW
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
FACING MACHINE
Ex-Cell-O Corp., Detroit.
FANS, EXHAUST, ELECTRIC VENTILATING
General Electric Co., Schenectady, N. Y.
Wagner Electric Co., St. Louis, Mo.
FEEDS FOR PUNCH PRESSES, AUTOMATIC
Cleveland Punch & Shear Works Co., Cleveland, O.
S. & S. Machine Wks., 4541 W. Lake St., Chicago.
U. S. Tool Company, Ampere, N. J.
V & O Press Co., Hudson, N. Y.
FILES
Chicago Wheel & Mfg. Co., 114 S. Aberdeen St., Chicago.
FILES, MACHINE
Oliver Instrument Co., Adrian, Mich.
FILES, ROTARY
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Lewis, B. C. Mfg. Co., Brooklyn, N. Y.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.
FILTERS, AIR
United States Electrical Tool Co., Cincinnati.
FILING MACHINES, DIE, ETC.
Ames, B. C., Co., Waltham, Mass.
Continental Machines, Inc., Minneapolis, Minn.
Grob Brothers, Grafton, Wis.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., Adrian, Mich.
Stow Mfg. Co., Binghamton, N. Y.
FITTINGS, HYDRAULIC
Hydraulic Press Mfg. Co., Mount Gilead, O.
Watson-Stillman Co., Roselle, N. J.
FLEXIBLE COUPLINGS
See Couplings, Flexible.
FLEXIBLE SHAFT EQUIPMENT
Dumore Co., Racine, Wis.
Foredom Electric Co., 27 Park Place, New York.
Haskins, R. G., Co., 617 So. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.
FORGING (UPSETTING) MACHINES
Baldwin-Southwark Corp., Philadelphia, Pa.
National Machinery Co., Tiffin, O.
FORGINGS, DROP
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.
FORGINGS, HOLLOW BORED
American Hollow Boring Co., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
FORGINGS, IRON AND STEEL
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
Morgan Engineering Co., Alliance, O.
FORGINGS, MANGANESE, BRONZE, ETC.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
FORGINGS, UPSET
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.
FORMING AND BENDING MACHINES
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Yoder Co., Cleveland, O.
FORMING AND STAMPING MACHINES
Cincinnati Shaper Co., Cincinnati.
U. S. Tool Company, Inc., Ampere, N. J.
FORMING TOOLS OR TOOL BLANKS
Brown & Sharpe Mfg. Co., Providence.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Pratt & Whitney Co., West Hartford, Conn.
FRAMES, MACHINERY, WELDED
Mahon, R. C., Co., Detroit, Mich.
FURNACES, EQUIPMENT FOR LOADING
Hydraulic Products Co., 525 W. 76th St., Chicago.
FURNACES, HARDNESS
Leeds & Northrup Co., Philadelphia.
FURNACES, HEAT-TREATING ELECTRIC
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
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Van Keuren Co., Watertown, Mass.
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Comtor Co., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.
Sheffield Corporation, Dayton, O.
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Federal Products Corp., Providence, R. I.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Slocomb, J. T., Co., Providence, R. I.
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Federal Products Corp., Providence, R. I.
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Sheffield Corporation, Dayton, O.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.
GAGES, ELECTRIC
Pratt & Whitney Co., West Hartford, Conn.
GAGES, HEIGHT
Brown & Sharpe Mfg. Co., Providence.
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Starrett, L. S., Co., Athol, Mass.
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Carboloy Co., Inc., Detroit.
Detroit Tap & Tool Co., Detroit, Mich.
Ex-Cell-O Corporation, Detroit.
Federal Products Corp., Providence, R. I.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
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Lees-Bradner Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Newark Gear Cutting Machine Co., Newark, N. J.
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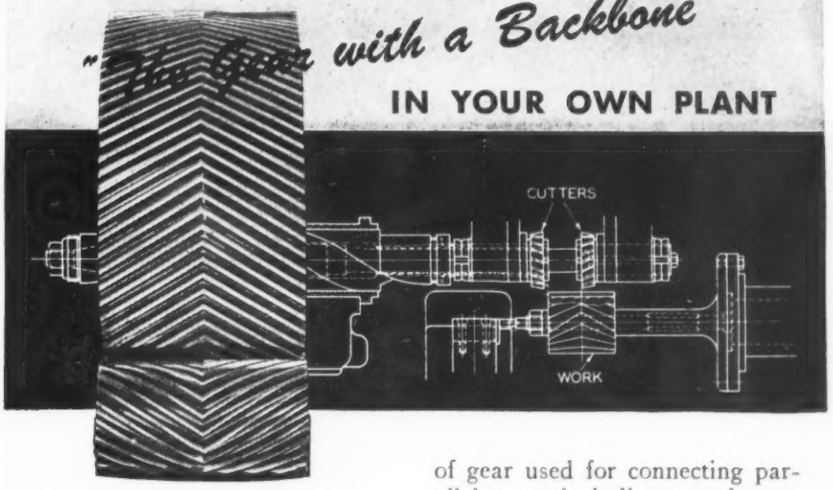

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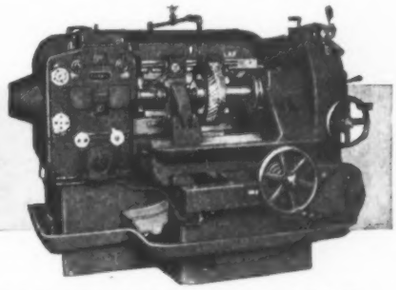

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Landis Tool Co., Waynesboro, Pa.
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Fitchburg Grinding Mch. Corp., Fitchburg, Mass.

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Thompson Grinder Co., Springfield, O.
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Hanchett Mfg. Co., Big Rapids, Mich.
Porter-Cable Machine Co., Syracuse, N. Y.
Production Mch. Co., Greenfield, Mass.
United States Electrical Tool Co., Cincinnati.

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Union Twist Drill Co., Athol, Mass.

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Waltham Mch. Wks., Waltham, Mass.

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Heald Machine Co., Worcester, Mass.
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Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
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Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

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Sundstrand Mch. Tool Co., Rockford, Ill.

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Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
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Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.

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Pittsburgh Gear & Mch. Co., Pittsburgh.

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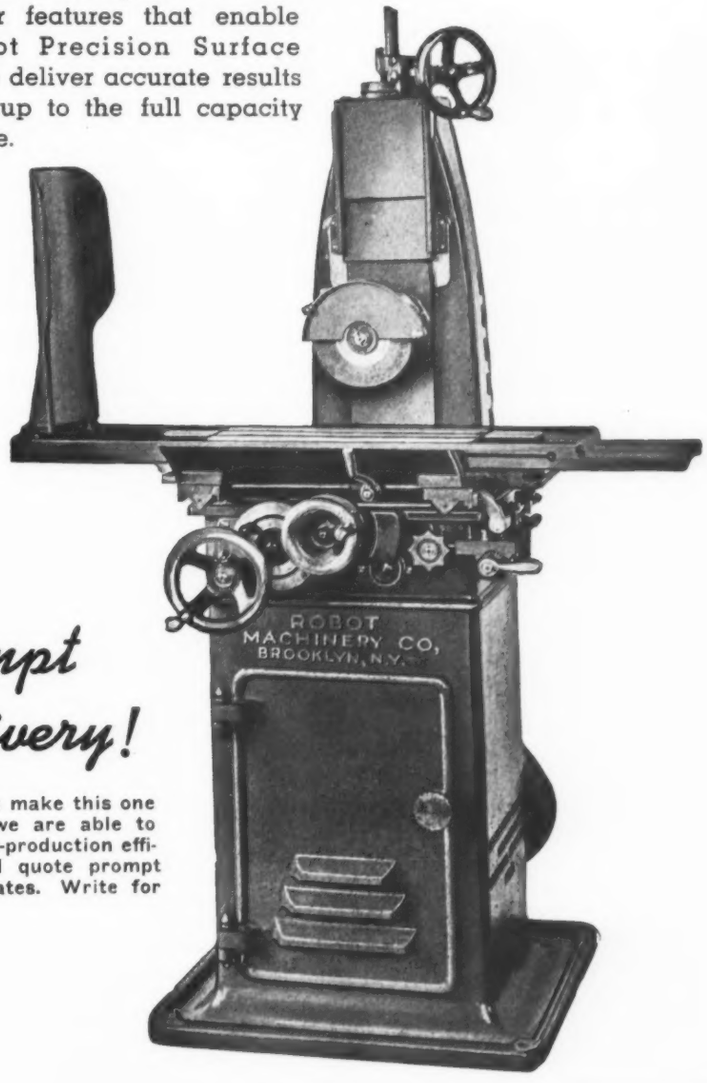
See Gear Cutting Machines, Helical and Spur (Hob); and Gear Cutting Machines, Worm and Worm Wheels.

Save Time!

TIME is your most valuable asset—save it by using the right machines for every job! Use the ROBOT 6 x 18 inch Precision Surface Grinder to speed up production of small parts, and release your larger machines for large work. Slip clutch reverse drive insures smooth reversal of table at any definite point. Long table ways add further to steadiness and accuracy. Spindle and spindle bearings are ground to tolerances within .0001". Write for complete description of these and other features that enable the Robot Precision Surface Grinder to deliver accurate results on work up to the full capacity of its table.

THE ROBOT PRECISION SURFACE GRINDER



Prompt Delivery!

Because we make this one size only we are able to attain mass-production efficiency and quote prompt delivery dates. Write for details.

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326 Ten Eyck St. BROOKLYN, N. Y.
EVERGREEN 7-4084-5-6

GRADUATING MACHINES
Gorton, George, Mch. Co., Racine, Wis.
Noble & Westbrook Mfg. Co., Hartford, Conn.

GREASE
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

GRINDERS, CARBIDE TOOL
Baldor Electric Co., St. Louis, Mo.
Oliver Instrument Co., Adrian, Mich.
Sundstrand Mch. Tool Co., Rockford, Ill.

GRINDERS, DIE AND MOLD
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
United States Electrical Tool Co., Cincinnati.

GRINDERS, OILSTONE, FOR WOODWORKING TOOLS
Mummert-Dixon Co., Hanover, Pa.

GRINDERS, PNEUMATIC
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., Chicago, Ill.
Rotor Tool Co., Cleveland, O.

GRINDERS, PORTABLE ELECTRIC AND TOOLPOST
'Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Schauer Machine Co., Cincinnati, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.
United States Electrical Tool Co., Cincinnati.

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Continental Machines, Inc., Minneapolis, Minn.
Delta Mfg. Co., Milwaukee, Wis.
Hill Acme Co., Cleveland, O.
Mattison Mch. Wks., Rockford, Ill.
Porter-Cable Machine Co., Syracuse, N. Y.
Production Machine Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., 96 Warren St., New York.

GRINDING MACHINES, BENCH
Atlas Press Co., Kalamazoo, Mich.
Delta Mfg. Co., Milwaukee, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schauer Machine Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.
Walker-Turner Co., Inc., Plainfield, N. J.

GRINDING MACHINES, CAMSHAFT
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CEMENTED CARBIDE TOOL
Carboloy Co., Inc., Detroit.
Ex-Cell-O Corporation, Detroit.
Oliver Instrument Co., Adrian, Mich.

GRINDING MACHINES, CENTERLESS
Cincinnati Grinders Inc., Cincinnati.

GRINDING MACHINES, CHASER, OR DIE
Eastern Mch. Screw Corp., New Haven, Conn.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.

GRINDING MACHINES, CHUCKING
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.

GRINDING MACHINES, CRANKSHAFT
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CYLINDER
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Hill, Clarke Mchy. Co., 649 Washington Blvd., Chicago.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CYLINDRICAL
Arter Grinding Machine Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Grinders Inc., Cincinnati.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Thompson Grinder Co., Springfield, O.
United States Electrical Tool Co., Cincinnati.

GRINDING MACHINES, DISC
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Porter-Cable Machine Co., Syracuse, N. Y.
Production Mch. Co., Greenfield, Mass.
United States Electrical Tool Co., Cincinnati.

GRINDING MACHINES, DRILL
Delta Mfg. Co., Milwaukee, Wis.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers, Wm., & Co., Inc., Philadelphia.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, FACE
Abrasive Mch. Tool Co., E. Providence, R. I.
Diamond Machine Co., Philadelphia, Pa.
Hanchett Mfg. Co., Big Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.

GRINDING MACHINES, FLEXIBLE SHAFT
See Flexible Shaft Equipment.

GRINDING MACHINES FOR SHARPENING TURNING AND PLANING TOOLS
Delta Mfg. Co., Milwaukee, Wis.
General Machinery Corp., Boston, Mass.
Oliver Instrument Co., Adrian, Mich.
Production Mch. Co., Greenfield, Mass.
Sellers, Wm., & Co., Inc., Philadelphia. (Machine Ground)
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Mch. Wks., Waltham, Mass.

GRINDING MACHINES, INTERNAL
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, JIG
Moore Special Tool Co., Inc., Bridgeport, Conn.

GRINDING MACHINES, KNIFE AND SHEAR BLADE
Hanchett Mfg. Co., Big Rapids, Mich.
Hill Acme Co., Cleveland, O.

GRINDING MACHINES, PISTON RING
Arter Grinding Machine Co., Worcester, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES, PROFILE
Boyar-Schultz Corp., Walnut St. at Hoyne, Chicago

GRINDING MACHINES, PULLEY
Abrasive Mch. Tool Co., East Providence, R. I.

GRINDING MACHINES, RADIAL, BALL RACE, ETC.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, RADIUS, LINK
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.

GRINDING MACHINES, RING WHEEL
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.

GRINDING MACHINES, ROLL
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

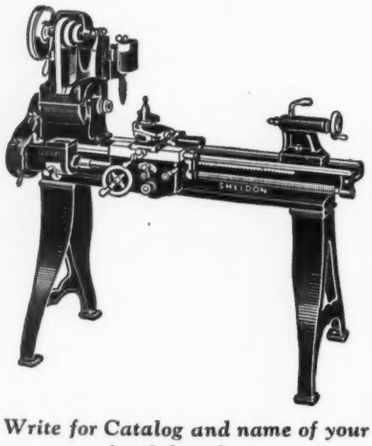
SHELDON Back Geared Screw Cutting PRECISION LATHES

For the Tool Room

The finest 10", 11" and 12" lathes ever built in the moderate price field: Large special analysis steel spindles *ground all over*, with extra collet capacity. Hand-scraped Bronze, Ultra-Precision Ball or Super-Precision Roller spindle bearings (the finest bearings obtainable). Heavy braced, semi-steel beds with hand-scraped ways (2 V-ways and 2 flat ways). These lathes come with a choice of aprons, gear boxes, and drives including the anti-friction, 4-speed, V-belt Lever-operated pedestal base motor drive illustrated. Telescopic Taper Attachment and other accessories available.

For Production

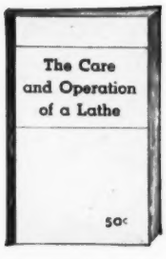
Sheldon Lathes will stand up to any production work within their capacity—are ideal for second operation work. Production models available with any or all of these features: Ultra-Precision Ball or Super-Precision Roller spindle bearings. Lever-operated Collet Attachment, Lever-operated Tail Stock, Lever-operated cross slide with double tool post, Lever-operated turret, etc.



For Machine Shop

Both Bench and floor models with choice of Semi-quick or Full-quick Change Gears, Plain Aprons or Worm Feed Apron with Power Cross Feed. Overhead, Back or Underneath Motor Drives — Telescopic Taper Attachments, Tool Post Grinders, Milling Attachments and all standard accessories.

Write for Catalog and name of your local distributor.



Just out "The Care and Operation of a Lathe" to help apprentice training. 50c list price, discounts for quantity purchases.

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4246 N. Knox Ave., Chicago, U.S.A.

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Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES, SURFACE
Abrasive Mch. Tool Co., East Providence, R. I.
Arter Grinding Machine Co., Worcester, Mass.
Barry Co., Inc., Muscatine, Ia.
Blanchard Mch. Co., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence.
Continental Machines, Inc., Minneapolis, Minn.
Foote-Burt Co., Cleveland, O.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Mch. Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland, O.
Leach, H., Machinery Co., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Robot Machinery Co., 326 Ten Eyck St., Brooklyn, N. Y.
Savage Tool Co., Minneapolis, Minn.
Sommer & Adams Co., Cleveland, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., Springfield, O.
United States Electrical Tool Co., Cincinnati.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, SWING FRAME
Jefferson Machine Tool Co., Cincinnati, O.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
United States Electrical Tool Co., Cincinnati.

GRINDING MACHINES, TAP
Ex-Cell-O Corp., Detroit.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.

GRINDING MACHINES, THREAD
Ex-Cell-O Corp., Detroit.
Jones & Lamson Mch. Co., Springfield, Vt.

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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Mch. Co., Oakley, Cincinnati.
Continental Machines, Inc., Minneapolis, Minn.
Douglas Machinery Co., Inc., 150 Broadway, New York.
Fellows Gear Shaper Co., Springfield, Vt. (Helical Gear Shaper Cutters).
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, WORM
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.

GRINDING WHEELS
Abrasive Co., Bridesburg, Philadelphia, Pa.
Bay State Abrasive Co., Westboro, Mass.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Blanchard Mfg. Co., Cambridge, Mass.
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.

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Taylor-Shantz, Inc., Rochester, N. Y.

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Chambersburg Engineering Co., Chambersburg, Pa.
Morgan Engineering Co., Alliance, O.

HAMMERS, PNEUMATIC
Madison-Kipp Corp., Madison, Wis.

HAMMERS, POWER
Quickwork-Whiting Div., of Whiting Corp., Harvey, Ill.

HAMMERS, SOFT
Chambersburg Engineering Co., Chambersburg, Pa.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
S. & H. Soft Hammer Products Co., Detroit, Mich.

HAMMERS, STEAM
Chambersburg Engineering Co., Chambersburg, Pa.
Sellers, Wm., & Co., Inc., Philadelphia.

HANGERS, SHAFT
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland, O.
Hyatt Bearings Div. General Motors Sales Corp., Harrison, N. J.
Sellers, Wm., & Co., Inc., Philadelphia.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

HARDENING EQUIPMENT, INDUCTION
Ohio Crankshaft Co., Cleveland.

HARDNESS TESTING INSTRUMENTS
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 382 Concord Ave., New York.

HEAT TREATMENT OF STEEL
Bennett Metal Treating Co., Elmwood, Conn.
Davis Boring Tool Div., St. Louis, Mo.
Ohio Gear Co., Cleveland, O.
Pittsburgh Gear & Mch. Co., Pittsburgh.

HOBBING MACHINES
See Gear Cutting Machines, Helical and Spur (Hob); and Gear Cutting Machines, Worm and Worm Wheels.

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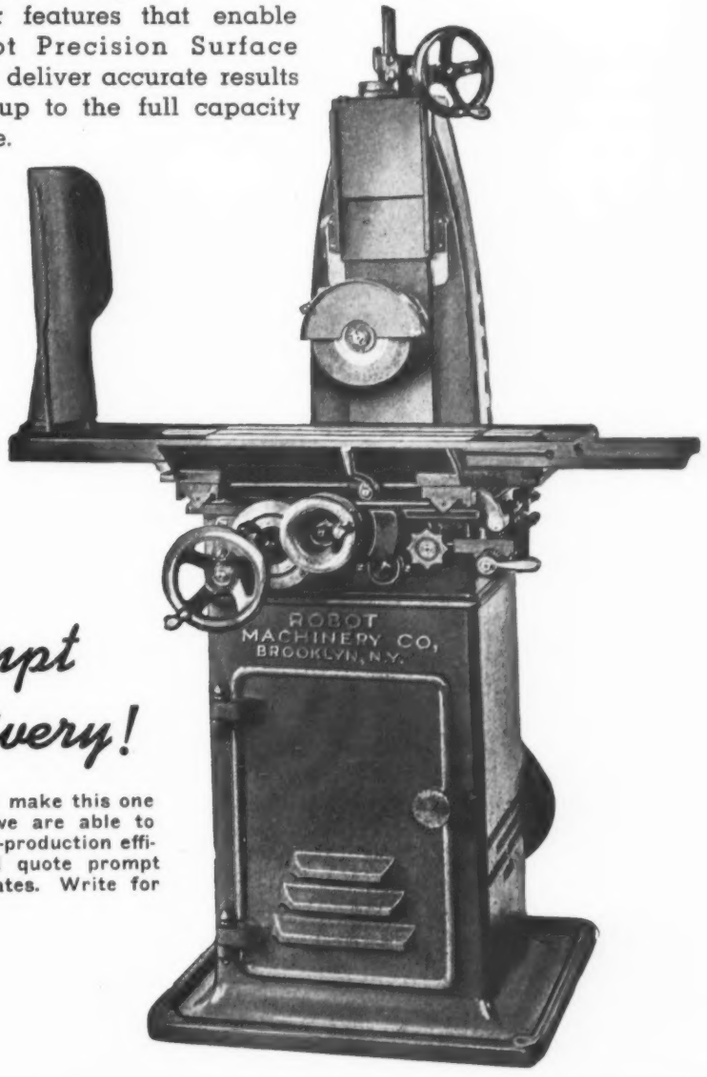
THE ROBOT PRECISION SURFACE GRINDER



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326 Ten Eyck St. BROOKLYN, N. Y.
EVERGREEN 7-4084-5-6

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HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Lees-Bradner Co., Cleveland.
Michigan Tool Co., Detroit, Mich.
National Twist Drill & Tool Co., Detroit.
New Jersey Gear & Mfg. Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.
U. S. Machine Tool Mfg. Corp., Terre Haute, Ind.

HOIST HOOKS
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Williams, J. H., & Co, 225 Lafayette St., New York, N. Y.

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Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS, AIR
Hanna Engineering Works, 1765 Elston Ave., Chicago.

HOISTS, CHAIN, ETC.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

HOISTS, ELECTRIC
Philadelphia Gear Works, Philadelphia.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONES
Carborundum Co., Niagara Falls, N. Y.
Micromatic Hone Corp., Detroit, Mich.
Moline Tool Co., Moline, Ill.
Sunnen Products Co., St. Louis, Mo.

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Automotive Maintenance Mchry. Co., 2100 Commonwealth Ave., Chicago.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Micromatic Hone Corp., Detroit, Mich.
Moline Tool Co., Moline, Ill.
Sunnen Products Co., St. Louis, Mo.

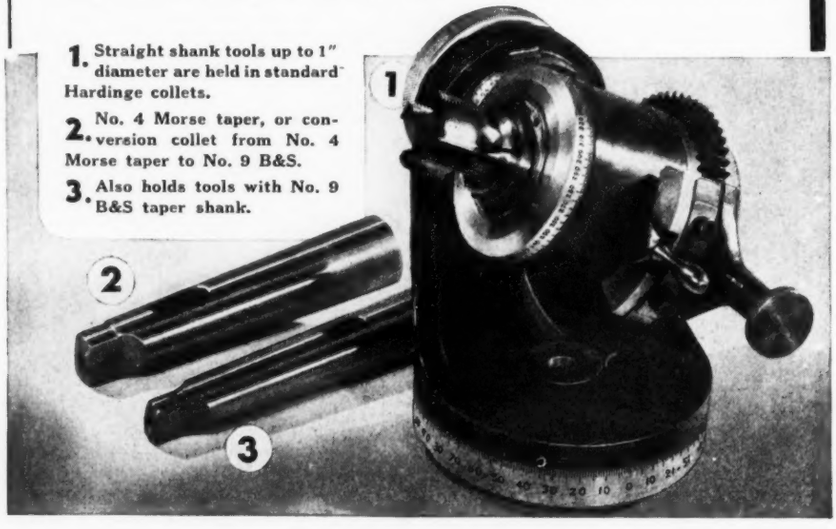
HONING MACHINES, EXTERNAL
Barnes Drill Co., Rockford, Ill.
Micromatic Hone Corp., Detroit, Mich.

HOSE, LEATHER, RUBBER, METALLIC, ETC.
Fauver, J. N., Co., Inc., Detroit, Mich.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Weatherhead Co., Cleveland, O.

THIS UNIVERSAL PRECISION INDEXING HEAD

can be used on any tool or surface grinder!

It holds all the tools shown below, and can easily be adapted to hold many others. Graduated 360° in three planes, for every simple or compound angle. Vernier lever will rotate work collet between indexed points without changing index or location of tool in collet. Accurate . . . useful . . . adaptable. Prompt delivery. *Write for illustrated circular.*



1. Straight shank tools up to 1" diameter are held in standard Hardinge collets.
2. No. 4 Morse taper, or conversion collet from No. 4 Morse taper to No. 9 B&S.
3. Also holds tools with No. 9 B&S taper shank.

CLEVELAND
TOOL ENGINEERING COMPANY
9101 DETROIT AVE. • CLEVELAND, OHIO

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Denison Engineering Co., Columbus, O.
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Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.

HYDRAULIC POWER UNITS
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Hydraulic Machinery, Inc., Dearborn, Mich.

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Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago

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Brown & Sharpe Mfg. Co., Providence, R. I.
Jefferson Machine Tool Co., Cincinnati, O.
Kempsmith Mch. Co., Milwaukee, Wis.

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Cleveland Tool Engineering Co., Cleveland, Ohio.
Hartford Special Mchry. Co., Hartford, Conn.

INDICATORS, DIAL
Ames, B. C., Co., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

INDICATORS, SPEED
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, L. S., Co., Athol, Mass.
Veeder-Root, Inc., Hartford, Conn.

INDICATORS, TEST
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

INGOTS, MANGANESE, BRONZE AND BRASS
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

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Baldwin-Southwark Corp., Philadelphia, Pa.
Farquhar, A. B., Co., Ltd., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.

JACKS, PLANER
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
American Measuring Instruments Corp., 240 W. 40 St., New York, N. Y.
Cleveland Universal Jig Co., Cleveland, O.
Columbus Die, Tool & Mch. Co., Columbus, O.
Ex-Cell-O Corporation, Detroit.
Hartford Special Mchy. Co., Hartford, Conn.
Hecker, A. W., Cleveland, O.
Logansport Machine, Inc., Logansport, Ind.
Modern Mch. Corp., Brooklyn, N. Y.
Sommer & Adams Co., Cleveland, O.
Sossner, Inc., New York, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.

KEYS, WOODRUFF TYPE
Whitney Chain & Mfg. Co., Hartford, Conn.

KEYSEATERS
Baker Brothers, Inc., Toledo, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Lapointe Machine Tool Co., Hudson, Mass.

KNURL HOLDERS
Graham Mfg. Co., Inc., E. Greenwich, R. I.
Pratt & Whitney Co., West Hartford, Conn.

KNURLING TOOLS
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Graham Mfg. Co., Inc., E. Greenwich, R. I.
Pratt & Whitney Co., West Hartford, Conn.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

LAPPING MACHINES
Automotive Maintenance Mchry. Co., 2100 Commonwealth Ave., Chicago.
Cincinnati Grinders, Inc., Cincinnati.
Ex-Cell-O Corp., Detroit.
Fellows Gear Shaper Co., Springfield, Vt.
Norton Co., Worcester, Mass.

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Atlas Press Co., Kalamazoo, Mich.
Bradford Machine Tool Co., Cincinnati, O.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Gisholt Mch. Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
McCrosky Tool Corp., Meadville, Pa.
Monarch Mch. Tool Co., Sidney, O.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, O.
Sundstrand Mch. Tool Co., Rockford, Ill.
United States Electrical Tool Co., Cincinnati.
Warner & Swasey Co., Cleveland.

LATHE DOGS
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

LATHES, AUTOMATIC
Baird Mch. Co., Bridgeport, Conn.
City Engineering Co., Dayton, O.
Gisholt Mch. Co., Madison, Wis.
Goss & DeLeeuw Mch. Co., New Britain, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Monarch Mch. Tool Co., Sidney, O.
National Acme Co., Cleveland.
Porter-Cable Machine Co., Syracuse, N. Y.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Reid Brothers Co., Inc., Beverly, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Brothers, Saginaw, Mich.

LATHES, AXLES AND SHAFT
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Sellers, Wm., & Co., Inc., Philadelphia.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.

LATHES, BENCH
Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Colborne Mfg. Co., Chicago, Ill.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Hardinge Brothers, Inc., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sheldon Mch. Co., 246 N. Knox Ave., Chicago.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.

LATHES, BORING
Gisholt Mch. Co., Madison, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Wickes Brothers, Saginaw, Mich.

LATHES, BRASS WORKERS'
Bardons & Oliver, Inc., Cleveland, O.
Gisholt Mch. Co., Madison, Wis.
Seneca Falls Mch. Co., Seneca, Falls, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Warner & Swasey Co., Cleveland.

LATHES, CRANKSHAFT
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Brothers, Saginaw, Mich.

LATHES, DOUBLE-END
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Brothers, Saginaw, Mich.

LATHES, DOUBLE END BORING
Wickes Brothers, Saginaw, Mich.

LATHES, ENGINE AND TOOLROOM
American Tool Wks., Co., Cincinnati.
Atlas Press Co., Kalamazoo, Mich.
Axelson Manufacturing Co., Los Angeles, Calif.
Bradford Machine Tool Co., Cincinnati, O.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Mackintosh-Hemphill Co., Pittsburgh, Pa.
Monarch Mch. Tool Co., Sidney, O.
Morey Machinery Co., Inc., 410 Broome St., New York.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Rockford Mch. Tool Co., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.
Sidney Machine Tool Co., Sidney, O.
Simmons Machine Tool Corp., Albany, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, O.
Wickes Brothers, Saginaw, Mich.

LATHES, EXTENSION BED AND GAP
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Gisholt Mch. Co., Madison, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Warner & Swasey Co., Cleveland.

LATHES, GUN
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Wickes Brothers, Saginaw, Mich.

LATHES, MANUFACTURING TYPE
Lipe-Rollway Corporation, Syracuse, N. Y.
Lodge & Shipley Mch. Tool Co., Cincinnati.

LATHES, SPINNING
See Chucking Machines.

LATHES, TOOLROOM
See Lathes, Engine and Toolroom.

LATHES, TURRET
Bardons & Oliver, Inc., Cleveland, O.
Bullard Company, Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Diehl, G. M., Machine Wks., Wabash, Ind.
Gisholt Mch. Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y. (Bench or Cabinet Mounting).
International Mch. Tool Corp., Indianapolis, Ind.
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Midland Machine Corp., 515 W. 35th St., Chicago.
Morey Machinery Co., 410 Broome St., New York, N. Y.
National Acme Co., Cleveland.
Oster Mfg. Co., Cleveland, O.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Production Machine Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Rogers Machine Works, Inc., Alfred, N. Y.
Simmons Machine Tool Corp., Albany, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Cleveland, O.
Warner & Swasey Co., Cleveland.

LATHES, TURRET AUTOMATIC
Potter & Johnston Mch. Co., Pawtucket, R. I.

LATHES, VERTICAL TURRET
Bullard Company, Bridgeport, Conn.
Rogers Machine Works, Inc., Alfred, N. Y.

LEVELS
Pratt & Whitney Co., West Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.
Universal Boring Mch. Co., Hudson, Mass.

LUBRICANTS, INCLUDING EXTREME PRESSURE (E.P.) MACHINERY LUBRICANTS
Cities Service Oil Co., 60 Wall Tower, New York.
Fiske Brothers Refining Co. (Lubriplate Div.), Newark, N. J.
Gulf Oil Corp., Pittsburgh, Pa.
Quaker Chemical Products Corp., Conshohocken, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.
White & Bagley Co., Worcester, Mass.

LUBRICATING SYSTEMS
Farval Corp., Cleveland.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.

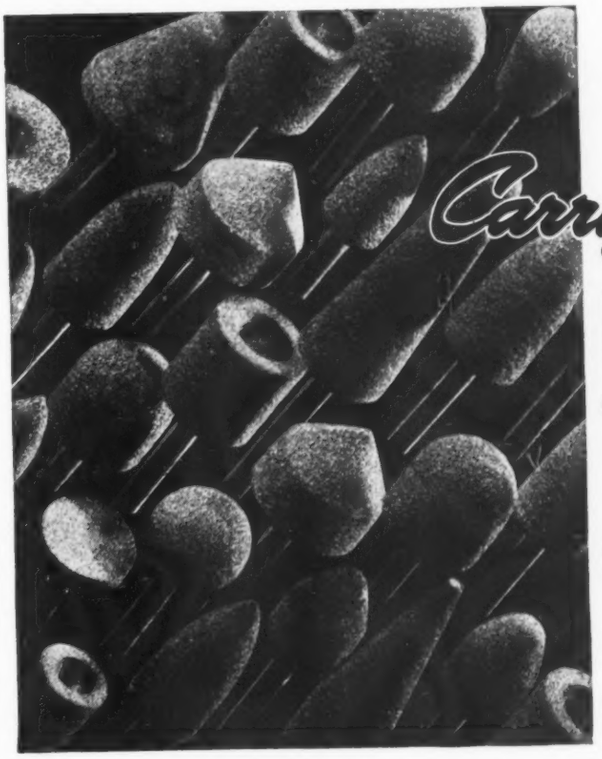
MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MAGNESIUM
Dow Chemical Co., Midland, Mich.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

MEASURING MACHINES, PRECISION
Federal Products Corp., Providence, R. I.
Hanson-Whitney Mch. Co., Hartford, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.



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Van Keuren Co., Watertown, Mass.

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See Bearings, Bronze, Babbitt, etc., and Bushings, Brass, Bronze, etc.

METALS, PERFORATED
Chicago Perforating Co., 2445 W. 24th Pl., Chicago.

METERS (See Recording Instruments).

MICROMETERS
Bath, John & Co., Inc., Worcester, Mass
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis & Thompson Co., Milwaukee, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Slocomb, J. T., Co., Providence, R. I.
Starrett, L. S., Co., Athol, Mass.
Van Keuren Co., Watertown, Mass.

MICROSCOPES, TOOLMAKERS
Scherr, George, Co., Inc., 126 Lafayette St., New York.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mch. Co., Milwaukee, Wis.
Porter-Cable Machine Co., Syracuse, N. Y.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, AUTOMATIC
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Jefferson Machine Tool Co., Cincinnati, O.
Jones & Lamson Mch. Co., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.
U. S. Tool Company, Inc., Ampere, N. J.

MILLING MACHINES, BENCH
Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Burke Machine Tool Co., Conneaut, O.
Hardinge Brothers, Inc., Elmira, N. Y. (Bench or Pedestal Type).
Jefferson Machine Tool Co., Cincinnati, O.
Pratt & Whitney Co., West Hartford, Conn.

MILLING MACHINES, CIRCULAR CONTINUOUS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, DIE SINKING
See Die Sinking Machines.

MILLING MACHINES, DUPLEX
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, HAND
Burke Machine Tool Co., Conneaut, O.
Frew Machine Co., Philadelphia.
Jefferson Machine Tool Co., Cincinnati, O.
Nichols, W. H., & Sons, Waltham, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, HORIZONTAL, PLAIN AND UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Continental Machines, Inc., Minneapolis, Minn.
De Vlieg Machine Co., Ferndale, Mich.
Douglas Mchy. Co., Inc., 150 Broadway, New York.
Frew Machine Co., Philadelphia.
Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mch. Co., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Calif.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Simmons Machine Tool Corp., Albany, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, LINCOLN TYPE
Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, PLANER TYPE
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sellers, Wm., & Co., Inc., Philadelphia.
Stokerunit Corp., Milwaukee, Wis.

MILLING MACHINES, PLANETARY
Cross Gear & Machine Co., Detroit, Mich.
Hall Planetary Co., Fox and Abbotsford Ave., Philadelphia, Pa.
Plan-O-Mill Corp., Royal Oak, Mich.

MILLING MACHINES, RAM TYPE, UNIVERSAL
Cross Gear & Machine Co., Detroit; Mich.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Continental Machines, Inc., Minneapolis, Minn.
Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Cal.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, O.
Sommer & Adams Co., Cleveland, O.
Sundstrand Mch. Tool Co., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Gorton, George, Mch. Co., Racine, Wis.

MOLDING MACHINES, PLASTIC PRODUCTS
Hydraulic Press Mfg. Co., Mount Gilead, O.
Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLYBDENUM
Climax Molybdenum, 500 Fifth Ave., New York.

MOTORIZED SPEED REDUCERS
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.

MOTORS, ELECTRIC
Baldor Electric Co., St. Louis, Mo.
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland.
Reliance Electric & Engrg. Co., Cleveland.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., E. Pittsburgh.

MULTIPLE-SLIDE FORMING MACHINES
Baird Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., Ampere, N. J.

NAME PLATES
Jefferson Machine Tool Co., Cincinnati, O.
Noble & Westbrook Mfg. Co., Hartford, Conn.

NIBBLING MACHINES
Gray Machine Co., Philadelphia.
Schatz Mfg. Co., Poughkeepsie, N. Y.

NICKEL
International Nickel Co., 67 Wall St., New York.

NIPPLE THREADING MACHINERY
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.

NUMBERING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, COLD FORGED, WING AND CAP
Parker-Kalon Corp., 200 Varick St., New York.

NUTS, SELF-LOCKING
Elastic Stop Nut Corp., Union, N. J.

NUTS, THUMB OR WING AND CAP
Williams, J. H., & Co., 225 Lafayette St., New York.

OIL CUPS
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OIL GROOVERS
Fischer Machine Co., Philadelphia, Pa.
Hanson-Whitney Mch. Co., Hartford, Conn.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OIL HOLE COVERS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Madison-Kipp Corp., Madison, Wis.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OILS, CUTTING
Acheson Colloids Corp., Port Huron, Mich.
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, LUBRICATING
Acheson Colloids Corp., Port Huron, Mich.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Fiske Brothers Refining Co. (Lubriplate Div.), Newark, N. J.
Quaker Chemical Products Corp., Conshohocken, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, QUENCHING AND TEMPERING
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.

OILS, SOLUBLE—See Compounds, Cutting, Grinding, Metal Drawing, etc.

OPTICAL WORK-LOCATING INSTRUMENTS
Center Scope Instrument Co., Los Angeles, Calif.

ORDNANCE MACHINES, SPECIAL
Rehnberg-Jacobson Mfg. Co., Rockford, Ill.

PACKING, LEATHER, METAL, RUBBER, ASBESTOS, ETC.
Garlock Packing Co., Palmyra, N. Y.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Watson-Stillman Co., Roselle, N. J.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, WOOD
Mummert-Dixon Co., Hanover, Pa.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS
Hill Acme Co., Cleveland, O.
Norma-Hoffmann Bearing Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE CUTTING AND THREADING MACHINES
Foote-Burt Co., Cleveland, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.
Peerless Machine Co., 1613 Racine St., Racine, Wis.

PIPE, IRON AND STEEL
Republic Steel Corp., Cleveland, O.

PIPE, STEEL
Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

PIPE TONGS
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

PLANER ATTACHMENTS
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hanson-Whitney Co., Hartford, Conn.

PLANERS
Baldwin-Southwark Corp., Philadelphia, Pa.
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y. (Incl. Plate, Rotary and Crank Types).
Liberty Planers, Hamilton, O.
Rockford Mch. Tool Co., Rockford, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

PLANERS, OPEN-SIDE
Cincinnati Planer Co., Cincinnati.
Liberty Planers, Hamilton, O.

PLATE ROLLS
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.

PLATES, SURFACE
Brown & Sharpe Mfg. Co., Providence.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Rotor Tool Co., Cleveland, O.
Smith Tool & Engineering Co., Bucyrus, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Company, Inc., Ampere, N. J.

PNEUMATIC EQUIPMENT
Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.

POLISHING LATHES AND MACHINES
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.

Continental Machines, Inc., Minneapolis, Minn.
Gardner Machine Co., Beloit, Wis.
Production Mch. Co., Greenfield, Mass.
Schauer Machine Co., Cincinnati, O.
Sundstrand Mch. Tool Co., Rockford, Ill.
United States Electrical Tool Co., Cincinnati.

POLISHING TOOLS, PORTABLE

Jarvis, Chas. L., Co., Middletown, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.

POLISHING WHEELS

Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.

PRESSES, ARBOR

Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
General Mfg. Co., Detroit, Mich.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.

PRESSES, BROACHING

American Broach & Mch. Co., Ann Arbor, Mich.
General Mfg. Co., Detroit, Mich.
Lapointe Machine Tool Co., Hudson, Mass.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.

PRESSES, EXTRUSION

Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

PRESSES, FOOT

Baird Machine Co., Bridgeport, Conn.
Etna Machine Co., Toledo, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
V & O Press Co., Hudson, U. Y.

PRESSES, FORGING

Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Farquhar, A. B., Co., Ltd., York, Pa.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, HYDRAULIC

American Broach & Mch. Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Denison Engineering Co., Columbus, O.
Diamond Machine Co., Philadelphia, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Lapointe Machine Tool Co., Hudson, Mass.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.

PRESSES, PERCUSSION

Wilson, K. R., Buffalo, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SCREW

General Mfg. Co., Detroit, Mich.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SHEET METAL WORKING

Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Cincinnati.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Farquhar, A. B., Co., Ltd., York, Pa.
Federal Press Co., Elkhart, Ind.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, O.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engineering Corp., Buffalo, N. Y.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, STRAIGHTENING

Baldwin-Southwark Corp., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Farquhar, A. B., Co., Ltd., York, Pa.
General Mfg. Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Morgan Engineering Co., Alliance, O.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frew Machine Co., Philadelphia.
Gorton, George, Mch. Co., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.
Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

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Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Sellers, Wm., & Co., Inc., Philadelphia.

PULLEYS, FRICTION CLUTCH

Brown & Sharpe Mfg. Co., Providence.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland, O.

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Estey Pump Co., Inc., Canandaigua, N. Y.
Logansport Machine, Inc., Logansport, Ind.
Pioneer Pump & Mfg. Co., Detroit, Mich.
Ruthman Machinery Co., Cincinnati.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

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Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence.
Lapointe Machine Tool Co., Hudson, Mass.
Racine Tool & Mch. Co., Racine, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.
Watson-Stillman Co., Roselle, N. J.

PUMPS, ROTARY

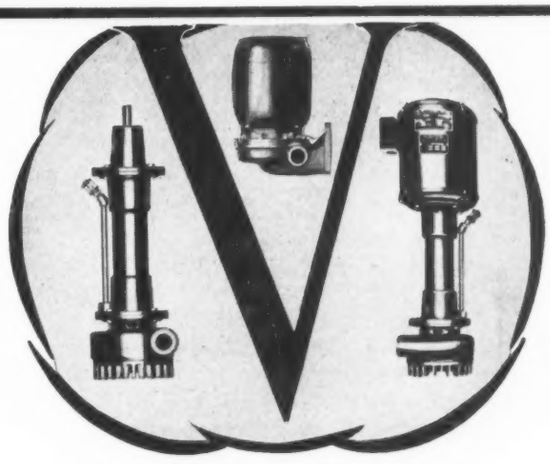
Pioneer Pump & Mfg. Co., Detroit, Mich.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, etc.

PUNCHES, CENTERING

Cleveland Punch & Shear Works Co., Cleveland, O.
Slocomb, J. T., Co., Providence, R. I.



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Niagara Machine & Tool Wks., Buffalo, N. Y.
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Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
Watson-Stillman Co., Roselle, N. J.
Wiedemann Machine Co., Philadelphia.

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Shore Instrument & Mfg. Co., Jamaica, N. Y.

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Brown & Sharpe Mfg. Co., Providence.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hartford Special Mchry. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.

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Gisholt Machine Co., Madison, Wis.
Landis Mch. Co., Inc., Waynesboro, Pa.
Lipe-Rollway Corporation, Syracuse, N. Y.
McCrosky Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Warner & Swasey Co., Cleveland.

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Black Drill Co., Cleveland, O.
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
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Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Columbus Die, Tool & Mch. Co., Columbus, O.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gammons-Hoaglund Co., Manchester, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
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Lipe-Rollway Corporation, Syracuse, N. Y.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

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Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Madison Mfg. Co., Muskegon, Mich.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Rogers, John M., Tool Corp., Gloucester, N. J.
Standard Tool Co., Cleveland, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Leeds & Northrup Co., Philadelphia, Pa.

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S. & S. Mch. Wks., 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

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Oakite Products, Inc., 26 Thames St., New York.

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Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

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Cleveland Punch & Shear Works Co., Cleveland, O.

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Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
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Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

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Avey Drilling Machine Co., Cincinnati.
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Grob Brothers, Grafton, Wis.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
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Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
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Walker-Turner Co., Inc., Plainfield, N. J.
Wells Manufacturing Corp., Three Rivers, Mich.

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Brown & Sharpe Mfg. Co., Providence.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Starrett, L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

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Anderson Bros. Mfg. Co., Rockford, Ill.

SCREW CUTTING TOOLS—See Taps and Dies.

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Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati.

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Cone Automatic Machine Co., Inc., Windsor, Vt.
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Jones & Lamson Machine Co., Springfield, Vt.
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Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
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Harper, H. M., & Co., Providence, R. I.
Holo-Krome Screw Corp., Hartford, Conn.
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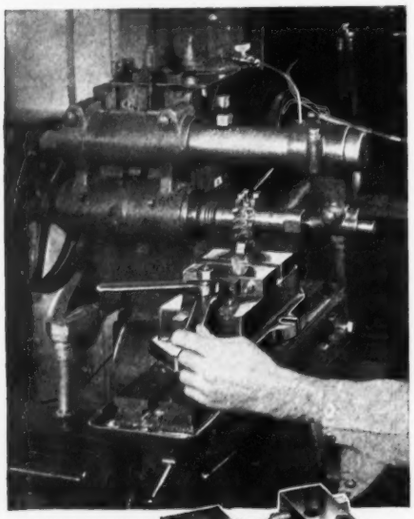

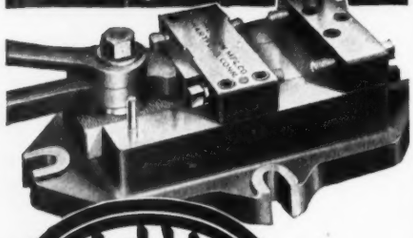

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Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York.

SOLDER FOR ALUMINUM AND CAST IRON
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., Bridgeport, Conn.
Baldwin-Southwark Corp., Philadelphia, Pa.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Barry Co., Inc., Muscatine, Ia
Bayard, M. L., & Co., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Wks., Philadelphia.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Blanchard Machine Co., Cambridge, Mass.
Cleveland Universal Jig Co., Cleveland, O.
Columbus Die Tool & Machine Co., Columbus, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis Boring Tool Co., Inc., St. Louis, Mo.
Denison Engineering Co., Columbus, O.
Earle Gear & Mch. Co., Philadelphia.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Ex-Cell-O Corp., Detroit.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Gairing Tool Co., Detroit.
Gisholt Mch. Co., Madison, Wis.
Gorton, George, Mch. Co., Racine, Wis.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hartford Special Mchy. Co., Hartford, Conn.
Hill Acme Co., Cleveland, O.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Jefferson Machine Tool Co., Cincinnati, O.
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Lake Erie Engineering Corp., Buffalo, N. Y.
Lipe-Rollway Corporation, Syracuse, N. Y.
Modern Machine Corp., Brooklyn, N. Y.
Moline Tool Co., Moline, Ill.
Morgan Engineering Co., Alliance, O.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland.
National Machinery Co., Tiffin, O.
National Twist Drill & Tool Co., Detroit.
New Jersey Gear & Mfg. Co., Newark, N. J.
Niagara Mch. & Tool Wks., Buffalo.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Pioneer Pump & Mfg. Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Ruthman Machinery Co., Cincinnati.
S. & S. Mch. Works, 4541 W. Lake St., Chicago.
Sundstrand Machine Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
U. S. Tool Company, Inc., Ampere, N. J.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cleveland Worm & Gear Co., Cleveland.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Davis & Thompson Co., Milwaukee, Wis.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston, Mass
Michigan Tool Co., Detroit, Mich.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, GRINDING
Ex-Cell-O Corporation, Detroit.

SPINDLES, HOLLOW BORED
American Hollowing Boring Co., Erie, Pa.

SPINNING LATHES
See Chucking Machines.

SPRING COILING AND FORMING MACHINERY
Baird Machine Co., Bridgeport, Conn.

SPRINGS, WIRE
Hunter Pressed Steel Co., Lansdale, Pa.

SPROCKET CHAINS
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.

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Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Grant Gear Works, Inc., Boston, Mass
Hartford Special Mchry. Co., Hartford, Conn.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

STAMPINGS, SHEET METAL
Jefferson Machine Tool Co., Cincinnati, O.
Laminated Shim Co., Inc., Glenbrook, Conn.
Taylor-Shantz, Inc., Rochester, N. Y.

STAMPS, STEEL, AND MARKING DIES
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pittsburgh Stamp Co., Inc., Pittsburgh.

STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disk Div., Borg-Warner Corp., New Castle, nd.
Monarch Steel Co., Indianapolis, Ind.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL ALLOYS
See Alloy-steels.

STEEL BARS
See Bars, Steel.

STEEL, COLD DRAWN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co. (U. S. Steel Corp. Div.), Cleveland.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Monarch Steel Co., Indianapolis, Ind.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, COMPOSITE TOOL AND DIE
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL, HIGH SPEED TOOL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Co., Latrobe, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, MACHINE
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, RUSTLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Republic Steel Corp., Cleveland, O.

STEEL, SPECIAL ANALYSIS
Republic Steel Corp., Cleveland, O.

STEEL STAMPS
Sossner, Inc., New York, N. Y.

STEEL, STAINLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

STEEL, STRIP AND SHEET
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Thomas Steel Co., Warren, O.

STEEL, ZINC, TIN AND COPPER COATED STRIP
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Thomas Steel Co., Warren, O.

STELLITE
Haynes Stellite Co., Kokomo, Ind.

STOCKS, DIE
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.

STONES, OIL OR SHARPENING
Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHT EDGES
Jones Machine Tool Wks., Inc., King of Prussia, Pa.
Starrett, L. S., Co., Athol, Mass.

STRAIGHTENING MACHINERY
Baldwin-Southwark Corp., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
General Mfg. Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Waterbury Farrel Fdry. & Mch. Co., Waterbury, Conn.

STRAPPINGS FOR SHIPMENTS
Signode Steel Strapping Co., 2616 N. Western Ave., Chicago.

STUD SETTERS
Errington Mechanical Laboratory, 200 Broadway, New York.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

SUB PRESSES
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
U. S. Tool Co., Inc., Ampere, N. J.
Waltham Mch. Wks., Waltham, Mass.

SUPERFINISHING MACHINES
Norton Co., Worcester, Mass.

SWAGING MACHINES
Cincinnati Shaper Co., Cincinnati, O.
Etna Machine Co., Toledo, O.
Torrington Co., Torrington, Conn.

SWITCHES
Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
National Acme Co., Cleveland.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

TACHOMETERS
Leeds & Northrup Co., Philadelphia.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Veeder-Root, Inc., Hartford, Conn.

TAPER PINS, STANDARD
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

TAP HOLDERS
Errington Mechanical Laboratory, 200 Broadway, New York.
Gairing Tool Co., Detroit.
McCrosky Tool Corp., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Brown & Sharpe Mfg. Co., Providence.
Buhr Machine Tool Co., Ann Arbor, Mich.
Errington Mechanical Laboratory, 200 Broadway, New York.
Ettco Tool Co., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., Worcester, Mass.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

TAPPING MACHINES
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Avey Drillingg Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Bakewell Mfg. Co., Los Angeles, Calif.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Berger Mfg. Co., Bridgeport, Conn.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Frew Machine Co., Philadelphia.
Geometric Tool Co., New Haven, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Haskins, R. G., Co., 617 So. California Ave. Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Modern Tool Wks., Rochester, N. Y.
Moline Tool Co., Moline, Ill.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
National Machinery Co., Tiffin, O.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

TAPPING MACHINES, NUT
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.

TAPS
Bath, John & Co., Inc., Worcester, Mass.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit, Mich.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mch. Co., Hartford, Conn.
Landis Mch. Co., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Pratt & Whitney Co., West Hartford, Conn.
Sossner, Inc., 161 Grand St., New York.
Standard Tool Co., Cleveland, O.
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Wks., Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.

TESTING EQUIPMENT, TENSION COMPRESSION, FATIGUE, ETC.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.

THERMOMETERS, INDICATING AND RECORDING
Leeds & Northrup Co., Philadelphia, Pa.

THREAD CUTTING MACHINERY
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Eastern Machine Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Lees-Bradner Co., Cleveland.
Modern Tool Wks., Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
National Machinery Co., Tiffin, O.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Wks., Rochester, N. Y.
Oster Manufacturing Co., Cleveland, O.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread.

THREAD MILLING MACHINES
Coulter, James, Machine Co., Bridgeport, Conn.
Hall Planetary Co., Fox and Abbotsford Ave., Philadelphia, Pa.
Hanson-Whitney Mch. Co., Hartford, Conn.
Lees-Bradner Co., Cleveland.
Plan-O-Mill Corp., Royal Oak, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Waltham Mch. Wks., Waltham, Mass.

THREAD ROLLING MACHINES
Acme Machinery Div. of The Hill Acme Co., Cleveland, O.
National Machinery Co., Tiffin, O.
V & O Press Co., Hudson, N. Y.

TIN AND TERNE PLATES
Bethlehem Steel Co., Bethlehem, Pa.

TOOL BITS, HIGH SPEED STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland, O.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

TOOL BITS, SPECIAL ALLOY
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Kokomo, Ind.
Vascoloy-Ramet Corp., North Chicago, Ill.

TOOL GRINDERS
See Grinders for Sharpening Turning and Planing Tools.

TOOL HEADS, ADJUSTABLE
Gairing Tool Co., Detroit.

TOOLHOLDERS
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland.
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Gisholt Machine Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Lovejoy Tool Co., Inc., Springfield, Vt.

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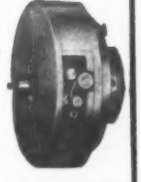

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Scully-Jones & Co., 1903 S. Rockwell St., Chicago. (Turret).
Slocomb, J. T., Co., Providence, R. I.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

TOOLMAKERS' INSTRUMENTS

Brown & Sharpe Mfg. Co., Providence.
Industrial Engineering Co., Inc., 141 W. Jackson Blvd., Chicago, Ill.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Starrett, L. S., Co., Athol, Mass.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

TOOLS, CARBIDE-TIPPED

Carbide Fabricators Co., Royal Oak, Mich.
Carboloy Co., Inc., Detroit.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
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McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Vascoloy-Ramet Corp., No. Chicago, Ill.

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Firth Sterling Steel Co., McKeesport, Pa.
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Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Jones & Lamson Mch. Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit, Mich.
O.K. Tool Co., Inc., Shelton, Conn.
Ready Tool Co., Bridgeport, Conn.
Slocomb, J. T., Co., Providence, R. I.
Vascoloy-Ramet Corp., North Chicago, Ill.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

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Wagner Electric Co., St. Louis, Mo.

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Reeves Pulley Co., Columbus, Ind.

TRUCKS, HYDRAULIC LIFT

Lyon-Raymond Corp., Greene, N. Y.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

TUBING, STEEL AND SEAMLESS STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
National Tube Co. (U.S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

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Baird Machine Co., Bridgeport, Conn.
Barry Co., Inc., Muscatine, Ia.

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Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.

TWIST DRILLS

See Drills, Twist.

V-BELTS

Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.

VALVES AND FITTINGS

Weatherhead Co., Cleveland, O.

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Baldwin-Southwark Corp., Philadelphia, Pa.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.
Racine Tool & Mch. Co., Racine, Wis.
Sundstrand Machine Tool Co., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.

VALVES, PNEUMATIC

Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

VISES, BENCH

Avey Drilling Machine Co., Cincinnati.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Fenn Mfg. Co., Hartford, Conn.
Jefferson Machine Tool Co., Cincinnati, O.

VISES, MACHINE

Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Avey Drilling Machine Co., Cincinnati.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Brown Engineering Co., 131 N. Third St., Reading, Pa.
Desmond-Stephan Mfg. Co., Urbana, O.
Fenn Mfg. Co., Hartford, Conn.
Graham Mfg. Co., Inc., E. Greenwich, R. I.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jefferson Machine Tool Co., Cincinnati, O.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Logansport Machine, Inc., Logansport, Ind.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.

VISES, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

VISES, PLANER AND SHAPER

Cincinnati Planer Co., Cincinnati.
Cincinnati Shaper Co., Cincinnati.
Graham Mfg. Co., Inc., E. Greenwich, R. I.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS

Shakeproof, Inc., 2553 N. Keeler Ave., Chicago.

WASHERS, LOCK

National Lock Washer Co., Newark, N. J., and Milwaukee, Wis.

WASHERS, SPRING

National Lock Washer Co., Newark, N. J., and Milwaukee, Wis.

WASHING MACHINES

Industrial Washing Machine Corp., New Brunswick, N. J.

WELDING AND CUTTING EQUIPMENT, OXY-ACETYLENE

Air Reduction Sales Co., 60 E. 42nd St., New York.
Linde Air Products Co., 30 E. 42nd St., New York.

WELDING AND CUTTING GASES

Air Reduction Sales Co., 60 E. 42nd St., New York.
Linde Air Products Co., 30 E. 42nd St., New York.

WELDING EQUIPMENT, ELECTRIC ARC

Air Reduction Sales Co., 60 E. 42nd St., New York.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

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Sciaky Brothers, Chicago, Ill.

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Ransome Machinery Co., Dunellen, N. J.

WIRE

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Phosphor Bronze Smelting Co., Philadelphia.

WIRE CLOTH

Buffalo Wire Works Co., Inc., Buffalo, N. Y.

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U. S. Tool Co., Inc., Ampere, N. J.

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Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

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Sidney Machine Tool Co., Sidney, O.
Walker-Turner Co., Inc., Plainfield, N. J.

WORM DRIVES

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Michigan Tool Co., Detroit, Mich.
Philadelphia Gear Works, Philadelphia, Pa.

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Standard Tool Co., Cleveland, O.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

WRENCHES, DETACHABLE SOCKET

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Greenfield Tap & Die Corp., Greenfield, Mass.

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Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

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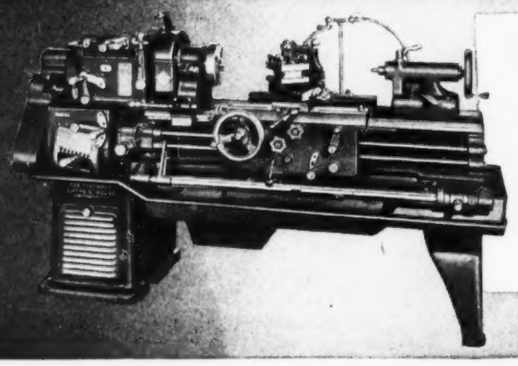
Standard Tool Co., Cleveland, O.

WRENCHES, TORQUE MEASURING

Elastic Stop Nut Corp., Union, N. J.
Sturtevant, P. A., Co., Addison, Ill.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

CINCINNATI LATHES



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Produced in 14" to 30" sizes, with 12 or 24 speeds, 32 to 96 threads and feeds, Cincinnati Lathes are capable of precision performance on an exceptionally wide range of operations. Cincinnati rugged construction helps to maintain the precision that is made into every part. Better to use Cincinnati Lathes when you must have versatility, precision and fast production.

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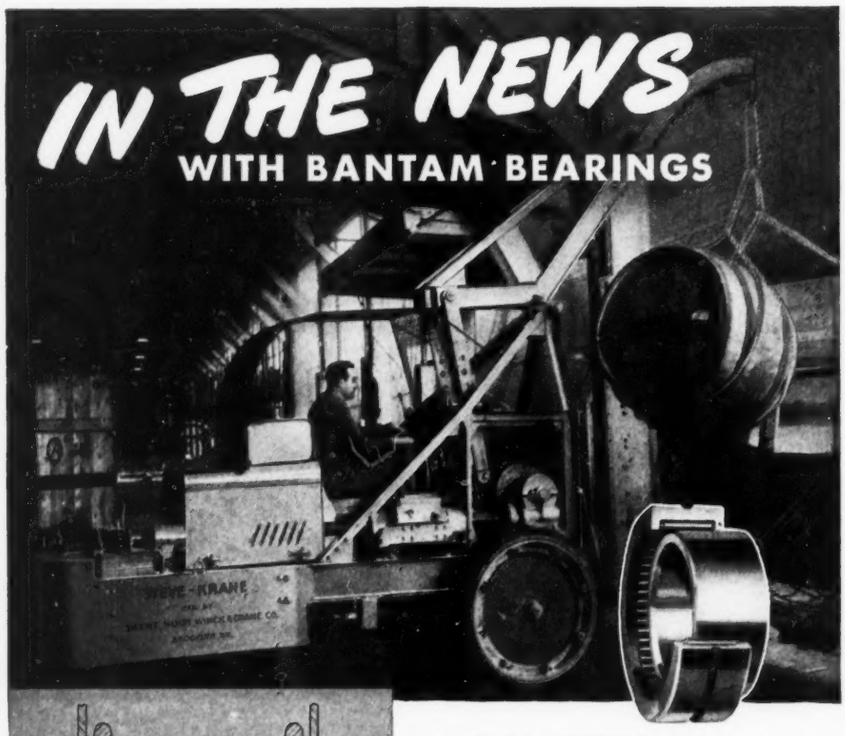
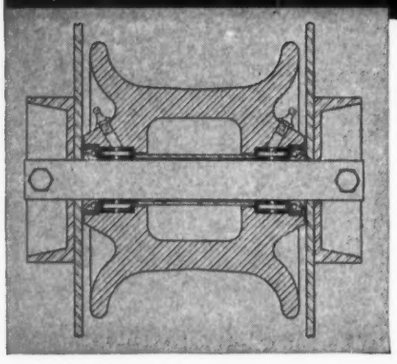
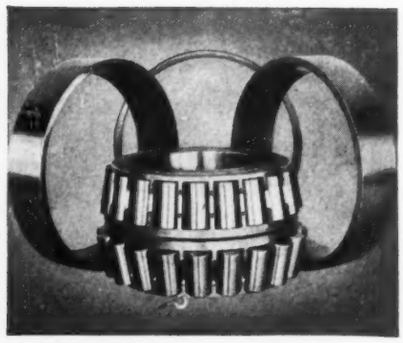
IN THE NEWS
WITH BANTAM BEARINGS



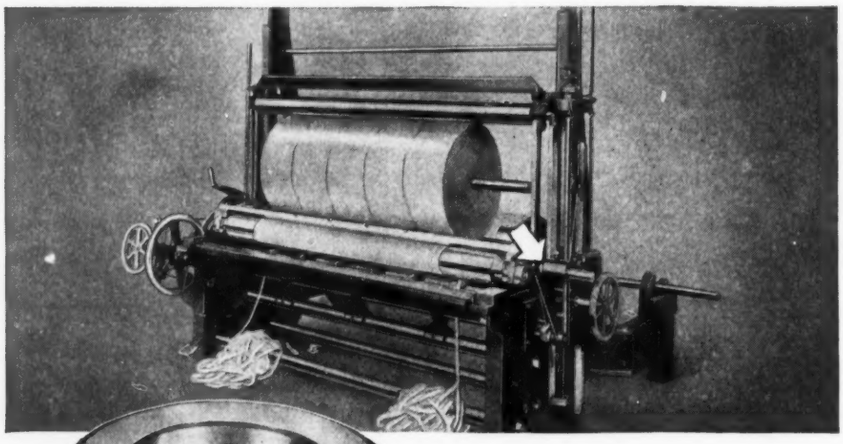


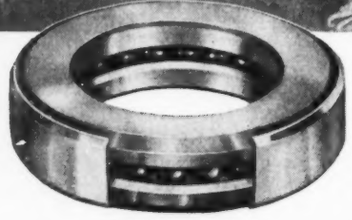
MECHANICAL "STEVEDORES" like this 5-ton STEVE-KRANE built by Silent Hoist Winch & Crane Co. are playing an important part in speeding the loading of goods and equipment for distant fronts. And Bantam Quill Bearings on the boom sheaves and rollers (shown in cross-section view) contribute to the efficiency of these cranes, because of their low coefficient of friction, high load capacity, and effective method of lubrication—while their unit construction facilitates assembly. For full details on these compact anti-friction bearings, write for Bulletin Q-104.



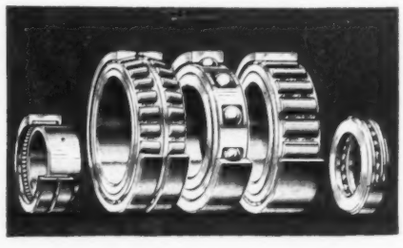
38" O.D., 21" I.D., 19½" LONG, this two-row tapered roller bearing for steel mill service is a typical instance of Bantam's skill in the design and manufacture of large bearings for special jobs. To meet the needs of America at war, Bantam today is manufacturing some of the largest anti-friction bearings ever built.

METALLURGICAL CHECK-UP is a regular part of Bantam inspection on bearings of all types. Here the grain structure of rollers and races is undergoing microscopic examination to assure conformity to metallurgical specifications.





FAST, ACCURATE SLITTING of paper is the job of the Camachine 8, Model 10, product of Cameron Machine Company. Among the factors in the popularity of this machine in paper mill finishing rooms and converting plants is the use of Bantam Ball Thrust Bearings.



ENGINEERING COUNSEL based on the design and application of straight roller, tapered roller, needle, and ball bearings is a vital phase of Bantam's service to industry. If you are seeking competent advice on your anti-friction bearing problems, TURN TO BANTAM.

ARMY (E) NAVY

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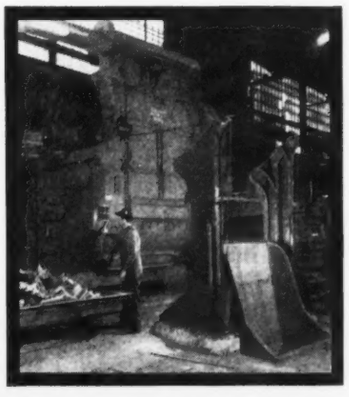

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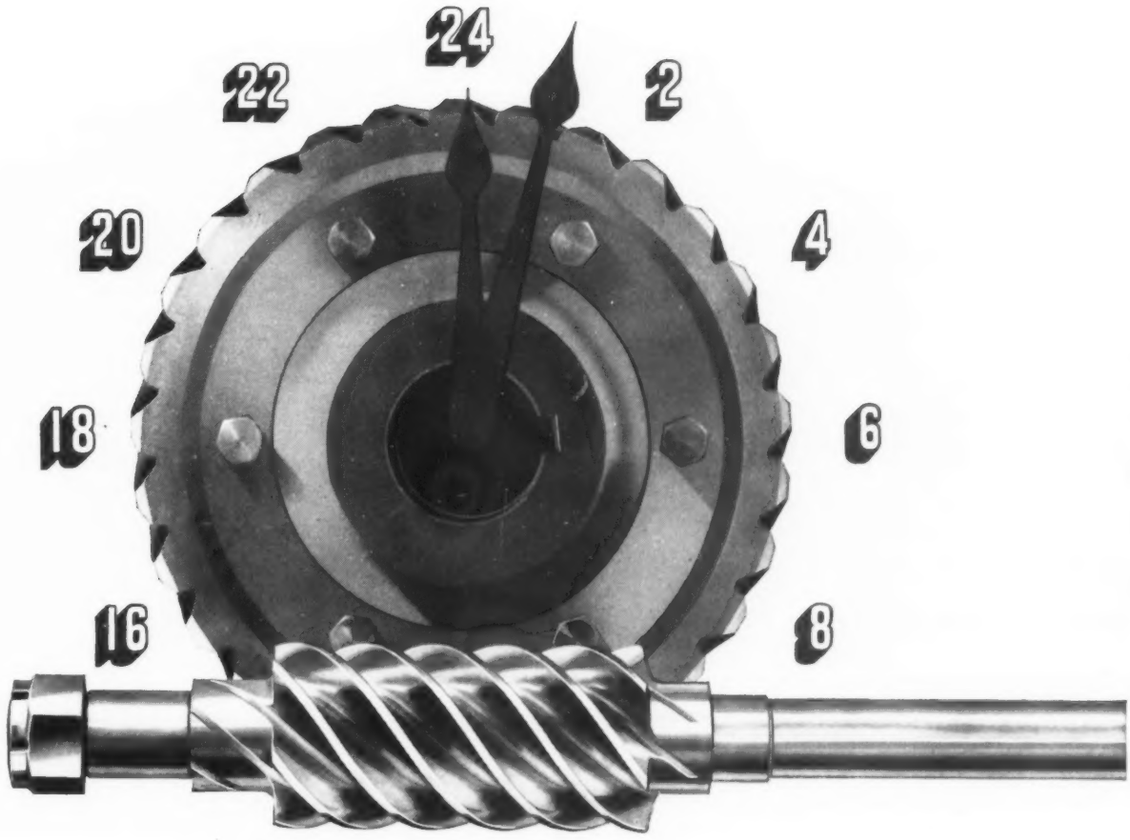

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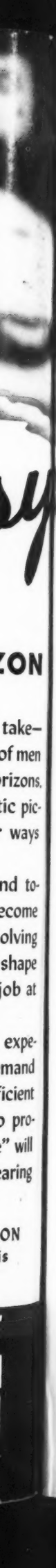
FOR SHAPES OF THINGS TO COME

CLEARING

MECHANICAL AND HYDRAULIC PRESSES